Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

PUBLISHED BY McGRAW PUBLISHING COMPANY INC.

Volume 74 NEW YORK, SATURDAY, DECEMBER 16, 1916 Number 25

Zoning Our Cities

THERE can be no doubt that in time each of the large cities of the country will be divided into zones restricted as to class of structure and occupancy. Such restrictions are absolutely essential if our cities, considered as a whole, are to become efficient. The word "efficient," as here used, applies to everything that can be reached by the police power of the state and that can contribute to public welfare and better health. Europe is far ahead of us in its municipal management, though here height-restriction ordinances are becoming more frequent, while zoning is not unknown. The restricted-district plan worked out in New York within the last two years and now effective is, of course, the most important step taken so far in the United States. Moreover, the conditions at New York were extremely complicated, so that no city in the country need fear to attack the problem on account of its complexity. In no other community in the United States will the factors be found so many and so involved. Chicago is now considering the matter. An ordinance is before the City Council which, if passed, will result in putting the matter officially before the legislature of the state. We trust that the measure will receive favorable consideration by Chicago's governing body, to the end that the second city of the country may join with New York in affording an example for the other communities of the country.

A Talk on City Planning

APROPOS of the previous remarks on the zoning of cities, it is not amiss to refer to one of the most stimulating as well as interesting talks which the editors of this journal have heard—that by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York, at a recent meeting of the American Society of Civil Engineers. While Mr. Lewis did not confine himself to restriction and zoning, he touched on these subjects as part of the general problem of city planning. Moreover, he brought out most forcibly the engineer's function in city planning, and warned the members of the profession that if they did not appreciate their opportunities and their responsibilities in this respect, the field would be preempted by other specialists, less qualified for the task. Engineering societies that can induce Mr. Lewis to talk before them will not only have a rare treat on account of the interesting way in which he presents his subject, but will get points of view on a growing and important field of engineering endeavor.

Reinforced-Gypsum Roof Decks

AN important modern development in the application of gypsum to long-span beam or deck-slab construction is described in the article by V. G. Marani on page 745 of this issue. It will be followed next week by an article on the methods used on the first building in which 10-ft. units, cast at the site, have been employed. The economic possibilities of material weighing only 17 lb. per square foot of roof surface is apparent, and, in addition, the low heat conductivity and fire-resistive qualities are advantages long recognized in the extensive use of gypsum tile for roofs and of gypsum blocks for partitions. The results given by Mr. Marani for the strength tests of the new construction should have the very careful attention of structural engineers. Undoubtedly a wide development awaits the material and the greater the number of engineers and experimenters interested the more rapid will be the development.

The Webb Bill

SELDOM has a business measure before Congress received so wide indorsement as the Webb Bill, which permits competing organizations to combine for foreign-trade exploitation. It has already been passed by the House of Representatives. The Senate's attitude is not known, but it is fair to assume that the reasonableness of the measure, its indorsement by business interests and the press, and even by the President in his recent annual message to Congress, will result in a favorable attitude toward the measure in the Senate. The real danger that confronts it is that in the rush of matters the bill may fail of consideration. This would be a calamity. As the President said, referring to the passage of the measure, "The thing must be done now, because the opportunity is here and may escape us if we hesitate or delay." Manufacturers throughout the country are studying the bill and are discussing ways and means of taking advantage of its provisions, so that if it is passed, there may be prompt action. One industry has already acted. Timber producers of the Pacific Coast have organized the Douglas-Fir Exploitation & Export Company to sell co-operatively in foreign markets and to apportion among themselves by agreement the business that may be developed. They have had the courage to proceed even before the bill has been enacted, confident that in a test in the courts the legality of their act would be upheld. Needless to say, the Federal Trade Commission and the Bureau of Foreign and Domestic Commerce have been kept duly apprised of the lumbermen's plans. What these manufacturers have already done, producers in other lines are contemplating. General action, however, will be withheld until the bill is passed. The importance to this country of the development of the large foreign trade cannot be overemphasized, and it is to the interest of all that the government permit our manufacturers to do as Europeans have done, and are doing—co-operate in the exploitation of foreign markets.

Fire Hazard in Frozen Pipes

IN a bulletin issued last year by the National Fire Protection Association attention is called to the fire hazard which frozen water pipes present. The warning is worth repeating at this season, for it offers an opportunity for waterworks engineers to reduce the number of conflagrations in their cities by educating water users to a realization of the dangers involved in attempting to thaw out service pipes by heat from burning oil-soaked rags or other ill-advised methods in which an open flame is used. The advice is timely, for this is the season when trouble with frozen mains begins. The proper way for the householder to restore an ice-clogged pipe to service is to wrap it with cloth and pour hot water upon it or, if the freezing is too severe to yield to this treatment, the best plan is to send for a plumber. Apparently this is a minor detail, but attention to it may prevent needless fire losses running into thousands of dollars.

Financial Considerations

IT IS with much surprise that the Engineering Record has noted a rather drastic address, delivered before an engineering society in England, in which the engineer is severely criticised for his failure to appreciate the financial phases of his enterprises. "There is undoubtedly among all technical men a feeling of contempt for financial results," says the speaker. We do not believe that the charge would hold in this country. The fact that the address was delivered before the Junior Institution of Engineers may, in part, explain the speaker's attitude. It may have been intended to carry effect by the severity of the arraignment. The speaker did, it is true, recognize that young engineers were particularly apt to neglect the financial effect of their work, and, thus limited, the Engineering Record can to an extent agree with him. But when he extends his strictures to "all technical men" this journal must part company with him. It does not know conditions in England; it does know them here, and feels that it is on safe ground in declaring that, by and large, American engineers do appreciate the financial side of the work intrusted to their care. It is but natural that the young man fresh from college should emphasize the technical and subordinate the financial. No matter how strongly and how often his teachers may emphasize the importance of costs, there is not and cannot be present a control similar to that wielded by a holder of the purse strings. Nor is there the salutary and chastening influence which comes from checking actual costs monthly against the estimates. But when the young man gets into practice he soon realizes that the economic side of what he does is equal in importance to the technical and he gives proper place in his thinking to the matter of cost.

The Engineer's Function

WHAT is said in the foregoing paragraph regarding the American engineer's appreciation of costs brings to mind a recent editorial in the Chicago *Daily News*, which protested against the inclusion in the report of the Chicago Traction and Subway Commission of any franchise plan devised by the engineers. We do not know the constitution of the editorial staff of the *News*, but we strongly suspect that the editorial in question was not written by a journalist but by a lawyer. It has all the provincialism that characterizes the attitude of that profession toward the members of other professions and avocations. The reason given by the *News* for its position is that "Chicago has always been careful to take the views of its advisers only on matters respecting which they are especially qualified to speak." It does not go on to prove, however, that the three engineers composing the Traction and Subway Commission are not "especially qualified to speak" on franchise questions. There may be certain legal phases on which the advice of the lawyers is needed, but it is absurd to suppose that the engineers in question would fail to avail themselves of counsel on these phases. Certainly, the financial and economic aspects of Chicago's subway and traction problem come within the engineer's function. The franchise relation, in modern contracts, is controlled chiefly by the financial features of the plan, and these in turn are essentially of an engineering character, dealing necessarily with operating costs, the life of structures, etc. Unquestionably in such a large problem as that presented at Chicago the experience available on every phase of the subject needs to be commandeered. Those who know the engineering temperament will not doubt that the engineers composing Chicago's Traction and Subway Commission have called to their aid all those who could help. But while counsel and help are needed, there is no law of the Medes and Persians which provides that only lawyers are capable of working out a satisfactory franchise relation, as lawyers are prone to think.

Dredging Work in a New Light

DOUBTLESS many contractors and not a few engineers entertain the notion that dredging, especially for land reclamation, is a very simple proposition, hardly calling for the study and effort demanded by bridge building or subway construction. True, when one visits a dredging contract there is so little to see that one is tempted to conclude there is "nothing to it." Even if the contract is a big one the units are scattered and only one can be seen at a time. Frequently even the crew of that one is out of sight, except for a man wandering without apparent object about the deck, if it be a "floater," or an aimless-looking individual or two on the levee if it be a land machine. Usually there is little to watch but the monotonous pouring of a muddy stream from a discharge pipe or the equally monotonous movements of a bucket or dipper whose very size and power are lost on the watcher by reason of the contrast with all outdoors.

But what keeps the muddy stream filled with a profitable percentage of solids? Why does the bucket come up time after time with a full load? Where are the brains behind these seemingly aimless monsters eating dirt out of ditches and spewing it up along the banks? A fascinating account of both the mechanical and human problems which these brains have worked out, and whose solution spells the reclamation to profitable uses of thousands of square miles of waste land, begins on page 730 of this issue. Written by a man who has himself contributed to the recent developments in this field, the three articles of this series will leave few readers in doubt as to whether dredging work requires as much foresight, energy and ability to handle men as any other branch of engineering construction.

The problem of providing an economical source of power for these tools, touched on in the first article, bids fair to be met with a solution that will point the way to a great improvement in all construction power plants where electric current is not available from an outside source. Mr. Shaw considers the internal-combustion engine driving an electric generator as the most feasible power unit for dredge service. More than a year and a half ago this journal pointed out the advantages of such a power plant for general contract work in remote sections.

To-day the human element is a factor in all construction work, closer study of which will give very large returns. The second article of this series, dealing with this element, is one of the most human documents this journal has had the good fortune to publish in recent years. The methods outlined by Mr. Shaw are suggestive not only to dredging contractors but to their brethren in other fields as well.

In the third article is brought out an admirable example of the way in which accounting systems and business methods can be adapted to the work in hand. The importance Mr. Shaw attaches to the value of close personal contact of managers with the work and field organization cannot be overstressed. This, too, applies to every sort of construction work.

All in all, the series is, in its field, one of the most important this journal has ever published.

American International Corporation's Activities

BECAUSE of its unusual scope and the attention it attracted upon its organization, the first published report of the activities of the American International Corporation has unusual interest. It is called a preliminary report and is addressed by the president to the stockholders assembled in annual meeting Dec. 6. What strikes one most forcibly is the wide range of the corporation's activities and the number and variety of propositions made to it. Moreover, it is apparent that the company has whipped an organization into shape in an incredibly short time. Possibly these things should create no surprise when the experience and ability of the officers and the members of the board of directors are considered.

No less than 1230 propositions seeking financial support and development have been presented to the corporation for investigation. Of these, the field of operation of 347 is in South America, 326 in the United States, 256 in Europe, 73 in Asia, 71 in the West Indies, 47 in Central America, 41 in Canada, 29 in South Africa and the remainder in Mexico, Australia and Alaska. The distribution of the European group is especially worth noting. Russia leads the list with 64 proposals, thus bearing out the statement frequently made that in Russia lie America's great foreign-trade and foreign-investment opportunities. Spain (and it will come as a surprise to those not familiar with foreign conditions) is second on the list, offering 47 investment opportunities. Thirty-nine came from Italy, 29 from France, 14 from England, while the 63 others are scattered throughout the other European countries. Of South American states, Brazil and Argentina, quite naturally, head the list, the former with 80 and the latter with 65 propositions. China, again supporting statements frequently made as to our foreign opportunities, offered no less than 45.

The classification as to the nature of the propositions is equally interesting. Foreign development work is essentially of an engineering character. Therefore transportation and communication (railroads, tramways, shipping terminals, telephones) head the list with a total of 332 cases. Mining and public utilities add 312 proposals to the engineering classification, while of the 156 classified under agriculture and under commerce and industry, a goodly proportion, such as irrigation, reclamation and manufacturing plants, have an engineering basis.

Of the proposals actually accepted and undertaken, readers of the Engineering Record have already been apprised, through the news columns of this journal, of three—the Uruguayan contract for the construction of waterworks and sewerage systems, the American International Terminals Corporation and the Chinese railroad concession. In addition, the corporation has acquired interests in the Pacific Mail Steamship Company, the Allied Machinery Company of America, the International Mercantile Marine Company and the New York Shipbuilding Company. A special corporation has been formed to take care of South American work, the Rosin & Turpentine Export Company has been organized and interest acquired in the United Fruit Company and in the tea-importing business.

It is apparent that these activities put the corporation in a new class among American business enterprises. Europeans have long been accustomed to see organizations expand in the export field; and undoubtedly here, the opportunities now being appreciated, other corporations will follow in the steps of the American International, provided our people will change their present point of view and be willing to invest in foreign enterprises. Such activities will create new markets for American goods and thereby help to stabilize our industrial structure. While a private enterprise, the work of the American International Corporation has a national import because of its bearing on the nation's industrial conditions.

A Study of Efficiency

THE work conducted by the Ministry of Munitions in England has come to be of the most intensive character. Every effort has to be bent toward turning out with comparatively untrained labor—principally women and youths—the maximum possible quantity of shell and other material. The ministry has therefore been driven to conducting an analysis of results in the search for the most efficient conditions of labor, and some of its results have proved to be of large interest.

In particular they bear out much that has been done in this country, but the data on a large scale have particular value. Some time ago recommendations were made as to the limitation of hours of work, including the suggestion that the weekly hours, including overtime, should not exceed 67 for men and 60 for women. A later report, after investigation of results, indicates that in many instances these hours are too long for the highest efficiency. In one instance it was found that in doing light machine work a large group of women increased the total output 8 per cent on a drop of the working week from a little over 68 hours to slightly less than 60. In a similar instance in which a body of youths under military age was employed a decrease of the working hours from 12 to 8 actually raised the weekly output 19 per cent.

Attention, too, is being directed to the results of proper intervals of rest, on which considerable stress has been laid by American investigators. In one instance rather widely quoted two training officers, on a bet, started their respective commands on a task in trench digging. One officer sent his men in to work as hard as they could and keep at it till the task was finished. The other deliberately sent his men in for all they were worth, and periodically took them out to rest, with the result that he won his bet with considerable to spare. This is a striking example of the rigorous way in which the modern theory of human activity works out in practice.

What effect demonstrations of this kind, hitherto not common in England, will have on general efficiency is impossible to say, but it looks very much as though the fruits of the experiments, somewhat familiar here, would be reaped across the water as well, a fact not to be forgotten in considering the probable commercial conditions after the close of the war. The general effects of the scientific study of manual labor are being amply shown here. One of the most recent instances is that of a very large factory crowded with work which is deliberately going on to multiple shifts, at least two, and three when necessary, each of 8 hours.

Additional data on all these matters are greatly to be desired for application when the stress of competition rises swiftly, as it is bound to do one of these days. It is no longer the man, or the machine, that must be considered alone, but the factors of the most efficient combination of the two.

Those First Valuations Again

EXCEPTION is taken by the carriers concerned to practically every feature of the first two tentative valuations reported by the Interstate Commerce Commission. The formal protests of the Atlanta, Birmingham & Atlantic Railway and the Texas Midland Railroad, which are abstracted on page 735, make it appear that the valuations have settled into a contest—the government versus the railroads. The commission has evidently declined to accept many of the views set forth by the railroads in the various valuation conferences. It seems, in fact, to have followed more closely the theories of the state commissions, eliminating intangibles together with items that many call tangible, deducting depreciation regardless of serviceability and reading into the Minnesota rate decision a prohibition against the true reproduction cost of land—and it goes without saying that the railroads have protested.

The fact that these two cases are in the nature of test cases has of course not lessened the efforts of the carriers to cover all the objectionable features of the reports. Besides the seeming fallacies pointed out by this journal in the issue of Nov. 11, page 579, the carriers criticise the program of construction, the classification of quantities, the unit prices, and even the very form of the reports, which, they say, renders it impossible to check or dispute the details. Whether there is ground for the criticisms of quantities and prices is for those familiar with the properties in question to say. There does seem to be basis for the objections to the piecemeal and incomplete character of the reports.

One issue raised by the Atlanta, Birmingham & Atlantic looks to be a pertinent one. The road, though the valuation was completed only recently, was valued as of June 30, 1914. At that time the road was in the hands of a receiver and in a bad way as to earnings and expenses. Apparently it was considerably overcapitalized. Since then the property has been reorganized, with a drastic assessment and a $20,000,000 reduction of capitalization, and there have already been decided improvements in the matter of net earnings. Yet there is no mention of all this in the commission's report. Technically, the commission has done the correct thing, producing its valuation as of the date of valuation. Practically, it has illustrated a trait of courts and commissions of presenting facts that mislead because other facts are ignored. The newspapers were quick to grasp the apparent fact that the first valuation reported showed only $24,000,000 value against $59,000,000 capitalization. However successful this and other railroads may ultimately be in proving that their present value exceeds their capitalization, the damage is done. Many will look no further, seeing that the first valuation has shown rank stock watering.

The carrier's protest should show thoughtful people the folly of too hasty conclusions. A circular from the general secretary of the Presidents' Conference Committee points out that the commission's own reproduction cost of the Atlanta, Birmingham & Atlantic, when made to include all of the items reported—land, materials and supplies and property owned but not used—together with $200,000 cash in hand, would be $29,032,413 instead of $24,154,998.

In this connection the Engineering Record regrets having ignored materials and supplies and property owned but not used in the total given on page 598 of the issue of Nov. 11. The figure of $26,446,441, plus $433,000 for materials and supplies, would, we take it, be the value for ratemaking purposes derived from the commission's report; but for a comparison with capitalization the additional $2,153,000 for property owned but not used should be included.

But the carrier claims much more than the $29,032,413. For the tangible items exclusive of land it claims $32,397,878 instead of $24,154,998; for tangible items not recognized by the government it claims $6,681,383, and for land, instead of $2,291,413, normal market value, it claims a reproduction cost of $8,192,369 plus $1,860,329 interest, or $10,052,698. Adding these we have $49,131,959 as compared with the $24,154,998 announced by the newspapers, and with $39,290,000, the present capitalization.

It is not necessary to accept the carrier's estimate on its face value to perceive that it is too early to say that the government's valuations are proving the widespread charges of overcapitalization.

Dredging Equipment for Any Contract Should Be Chosen to Fit Exactly the Conditions Expected

If a Job Does Not Justify Installation of Proper Equipment, It Does Not Justify a Bid—Conditions Governing Dredging on Reclamation Work and How Four Common Types of Dredge Meet Them

By ARTHUR M. SHAW
Consulting Engineer, New Orleans, La.

IN APPROACHING a dredging job of any magnitude the first and most important problem which confronts the contractor is the selection of the most suitable equipment. To the contractor the difference between the performance of a dredge which is of just the right type for the work in view and one which will "do nearly as well and save buying a new outfit" will often represent the difference between a profit and a loss. Contractors doing a large general business may well afford to maintain a fleet of dredges from which they can select the proper type for any ordinary work offered. Even with companies controlling a wide variety of outfits, however, it is often most economical to provide entirely new equipment for special work in order that the special conditions may be met in the most efficient manner. No work of importance should be undertaken with equipment unsuited to its peculiar conditions. If the profits which may reasonably be expected are not large enough to justify the installation of the proper equipment, they are not large enough to justify the labor, expense and risk involved in placing a bid.

PAST PERFORMANCE BEST GUIDE IN SELECTION OF EQUIPMENT

The best guide in the selection of equipment is found in records of past performances, though it should be kept in mind that good results have been secured in individual instances by nearly every type of machine now being sold. Prospective purchasers are frequently led into error by the misapplication of data secured under conditions varying materially from those which will obtain on the work in view. Certain well-developed types of dredges will work economically under a considerable range of conditions, but there is no one machine which is best suited to all, or even to most conditions.

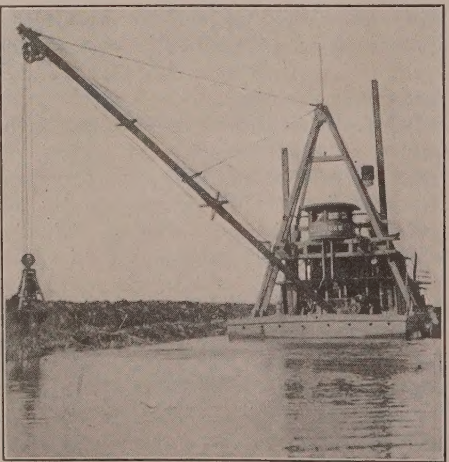
This discussion of various types of equipment and the power plants used to operate them is confined principally to those used in the reclamation of lands in the lower Mississippi delta. The types considered are dipper dredges, orange-peel and clamshell dredges, hydraulic dredges and dragline dredges. Other types which have been used to a limited extent will not be considered in this discussion. There have also been developed certain types of wheel ditching machines capable of digging such large ditches that they might almost be considered under the head of dredges. In their manner of operation and style of organization, however, they have not enough in common with the ordinary dredge for consideration here.

TWO TYPES OF DIPPER DREDGES

Dipper dredges may be mounted on scows or may be operated on land. In the latter case they are supported on car wheels, with short sections of portable track, on broad-tread wheels for running on planks or on hard ground, on rollers for moving on planks, or on caterpillar treads, or are rigged as "walking" dredges. Wherever it is practicable to secure sufficient water the floating dredge is usually preferred, as the expense and delays incident to moving ahead as the work progresses are reduced to a minimum with this type. On isolated work, requiring frequent tearing down and rebuilding, if a floater is to be used, the land outfit is preferred.

> WHEN MR. SHAW'S ARTICLES *were received by the Engineering Record they were described by the editor who examined them as "one of the most human documents we have ever received."*
>
> THE FIRST ARTICLE, *published below, describes the common types of dredges used in land-reclamation work, with the advantages and limitations which suit each to the different conditions met; it also analyzes the types of power plant in use, foreshadowing the application of electric power generated with internal-combustion engines.*
>
> THE SECOND OF THE SERIES, *to appear in the issue of Dec. 23, outlines the advantages of progressive training for employees—a plan by which every man is prepared to step into the place above him, giving the men an incentive to stay with the job and reducing delays from illness or changes in personnel.*
>
> THE THIRD ARTICLE, *which will be published Dec. 30, emphasizes the necessity for close contact with the work and constant watchfulness — necessary to success in any undertaking—and tells how they are maintained by the successful dredging contractor.*—EDITOR.

Tearing down and rebuilding a floating dredge is a tedious and expensive operation. The salvage from an ordinary wooden hull is usually a negligible (and frequently a minus) quantity. Some of the new types of steel hulls, built in sections, have met these objections in an ingenious manner and should materially increase the field of operations of floating dredges. In a number of cases moderately large dredges have been moved intact over considerable distances across land, but the writer has yet to learn of any individual owner who has made such an experiment and who is ready to attempt it a second time.



BUCKET DREDGE WITH LONG BOOM WOULD BE USEFUL IN LEVEE BUILDING

VERTICAL AND BANK SPUDS COMPARED

The greatest variation in the details of floating dipper dredges is found in the types of spuds used, in the manner of raising and lowering the spuds and in "pinning up." There are two general types in common use—the vertical and the bank spuds. Vertical spuds are comparatively simple, are adaptable to a wide range of depth and are independent of the width of canal. They are usually raised and lowered by independent engines, either by means of cables or by compound gears engaging a heavy rack which is attached to the spud. Cables are now quite generally preferred, though the rack is still in common use and is preferred by some. Neither type has any marked advantage in the matter of simplicity. The cable system has one considerable advantage in that it permits setting the engines farther aft, where they can be more easily attended to by those having the care of the main engines.

The power for raising spuds on some dredges is compounded by means of worm gears, but the writer considers a worm gear a necessary evil, to be tolerated on some machines but never on a dredge.

Bank spuds give greater stability to the hull, being, as their name implies, set out on the berm or bank. They permit the use of a much longer boom on a dredge of given width than is possible by the use of vertical spuds. On some machines the bank spuds act as an outboard support, the strain being carried to the hull by a well-braced structure acting as a beam. In other cases the strain is transferred direct to the top of the A-frame. That portion of the spud which rests on the bank is in the form of a plank platform, and for work in soft material these platforms are extended so as to cover a considerable area. In some cases these platforms are hinged along the center so that they may be more easily raised out of sticky material. One of the principal objections to bank spuds is that they often crush down the berm, inducing slides in the levee or waste bank. It is impracticable to use bank spuds in wide canals or open water of any considerable depth.

Owing to the powerful thrust of the dipper acting in various directions, the rigid bracing of spuds and fastening of all spud connections, whether of the vertical or bank type, are most important.

DIPPER DREDGE BEST FOR HARD DIGGING

Comparison with other types of dredges is most favorable to the dipper type when working in hard, compact material such as cemented gravel and ledge rock. It is usually preferred for digging through heavily timbered country, especially through trees having large tap roots. Its ability to bring a tremendous amount of power to bear at a single point contributes to its popularity in heavy timber work. Whenever possible, however, all large stumps should be loosened and shattered before the dredge reaches them.

Dredges are designed for handling earth, and there is no economy in delaying and overstraining them in grubbing stumps when it is reasonably practicable to remove, or at least loosen, the stumps by other means. In soft ground, blowing stumps entirely out of the ground should not be attempted, as the ground beneath them does not afford sufficient resistance to make this possible without an excessive cost for dynamite. A better plan is to bore a hole into the stump and place the explosive where its shattering effect will be the greatest.

Blasting Pays with Dipper Dredge

Hard gravel and rock should be blasted ahead of the dredge even though it may be possible to make some progress without first loosening the material. Dipper dredges equipped with crowding engines on the boom and with special teeth on the bucket will make fair progress without preliminary blasting in soft limestone rock which is in fairly thin layers. It will usually be found more economical, however, to do some preliminary blasting in all such material.

Loss of time frequently occurs in the use of a dipper dredge by the jamming into the bucket of a large stump or boulder, though a skillful operator will seldom permit this to occur.

In mucky soils dipper dredges often disintegrate the material to such an extent that much of it is carried in suspension in the canal for several hours, to be deposited later in the bed of the canal and materially reduce the section. In the very soft trembling prairies of southern Louisiana this will occur to a certain extent with any type of dredge, but is most noticeable with dipper and dragline machines, which require a long movement of the bucket in filling.

Grab-Bucket Dredges Handle Sand or Mud and Build Levees

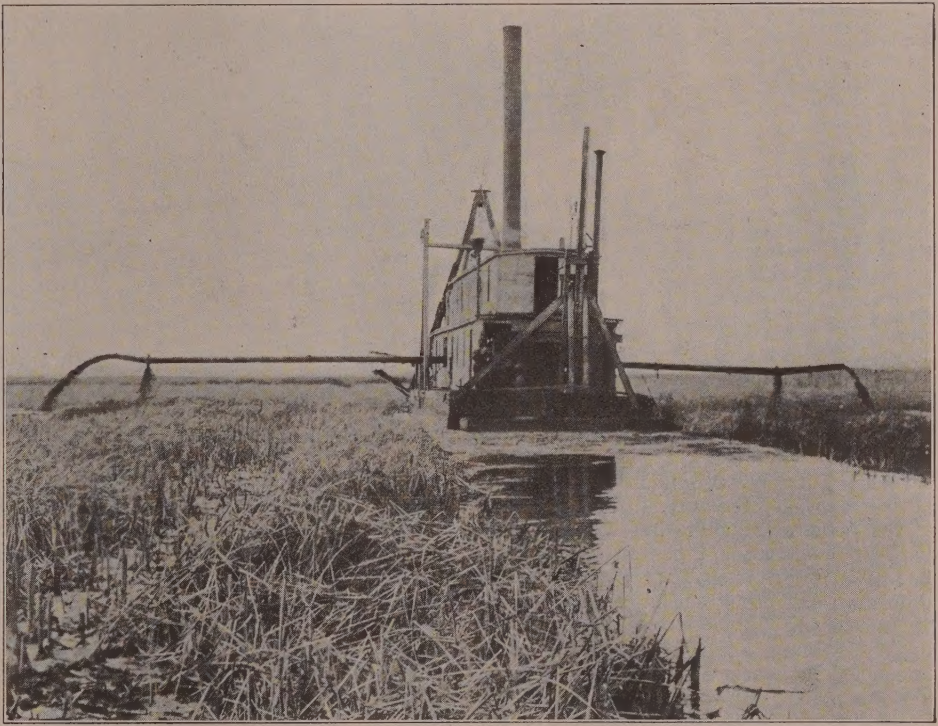
Variations in mounting and methods of moving are much the same with grab-bucket dredges as with the dipper type. Spuds are usually cable-operated. The spuds are used as anchors only, since there is less necessity for pinning up a dredge with this class of machinery. For levee construction and other classes of work on which the bulk of the material is to be dumped to one side of the excavation, gravity swing outfits are preferred on account of their simplicity, low first cost and economy of operation.

Orange-peel and clamshell buckets are most efficient in handling gravel, sand and soft material, though boulders, pig iron and blasted ledge rock are handled economically by the larger, three-bladed orange-peels of extra-heavy construction. In hard, packed sand the clamshell is most suitable, as it gathers its load by the scraping action of the blades. In hard digging teeth are placed on the edges of clamshell buckets for loosening the material. Though, owing to the large number of wearing parts, repairs are frequently required with grab buckets, they are readily made, usually by the substitution of small bushings and pins. A liberal supply of these repair parts should be kept in stock. It is usually found most economical to keep an extra bucket on hand so that at least one may be in perfect condition at all times.

Orange-Peel Best for Loading on Irregular Surface

Orange-peel buckets are preferred to clamshells for digging stumps, widening canals and other work where it is necessary for the bucket to fill on irregular surfaces or grab hold of materials of varying density. For digging stumps other than those having large tap roots the orange-peel dredge of large size is fully equal to any other type. Its ability to dig on all sides of a stump, tearing loose each individual main root, makes up for its lack of the great lifting and shoving power of the dipper dredge.

While not well adapted to digging hard sand, the orange-peel bucket may be used in such material with moderate success if properly handled. To insure economical loading the bucket should be dropped into the pit in a partly closed position, the blades being held as nearly vertical as practicable. After dropping, the closing line should be overhauled slightly and released, repeating this operation as many times as may be necessary to load the bucket. It is not usually feasible to secure a full load by this method, nor is this desirable, as the "suction" in such material is so great that it is almost impossible to break loose with a full bucket of packed sand.



WHERE ADJACENT LAND MAY BE FLOODED, SUCTION DREDGE IS OFTEN BEST TOOL

Discharge lines, supported by guys from A-frame, cocked up at ends so heavy material can escape at open joint and form ridge to dam fine silt back from canal section.

Though careless manipulation of dredges of any type when working in soft muck will stir up the material in much the same manner as will a dipper dredge, grab buckets, if intelligently handled, will excavate such material much better than any other bucket dredge. When working in material easily carried in suspension by the water, the bucket should not be permitted to bury itself in the bottom of the canal, but should be held by the "standing line," so that it will load with only such material as it can take out of the canal. Overloading and consequent dropping of broken material back into the water is the cause of most of the loss in section through sedimentation of canals dug by grab buckets. In cleaning out old canals which have become partly filled with fine ooze especial care is necessary to insure tight closing of the bucket. In the tough muck and Sharkey clay which are typical of the lower Mississippi delta grab buckets may be loaded 30 to 40 per cent beyond their rated capacity without danger of any considerable portion of the load dropping off.

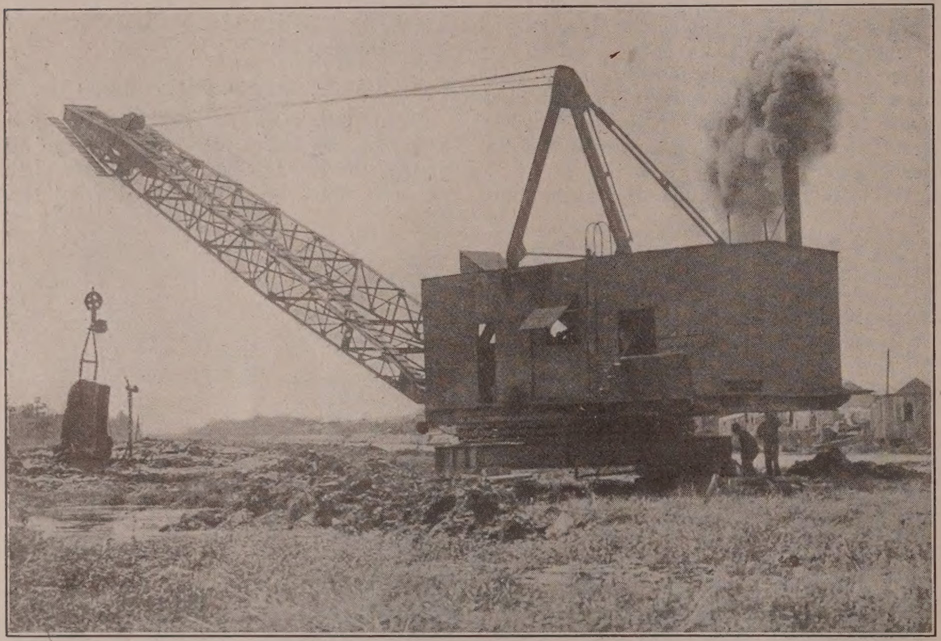
Grab-Bucket Dredge Could Build Levees

Until quite recently most of the river levees on the lower Mississippi were built by wheelbarrow or team work. These methods are now largely superseded by land dredges and by tower and cable rigs, though a few floating dredges are also used. As the material for building these levees is taken from the river side and land equipment cannot be operated excepting during moderately low stages of the river, the working period is reduced to a few months of each year. It would seem as though, by making a slight modification in the specifications for the construction of these levees, it would be possible to use floating dredges with extra-long booms for a large portion of such work.

Economy would be effected both by the use of more efficient equipment and by making possible a longer working season. With a fleet of dredges, either privately or publicly owned, such as those described by Fred H. Tibbetts in *Engineering News* of Sept. 4, 1913, page 456, the levee authorities would have available an excellent equipment for coping with many of the emergencies which have in the past resulted in disaster.

Dragline Essentially Land Machine

It is seldom that a dragline dredge is mounted on a barge, as its operation tends to form a mud roll ahead of the bucket which cannot easily be removed excepting as the machine backs away from its work. Dragline machines are moved on rollers, trucks or caterpillar treads. The "whirler" type is usually preferred, as it can reach back for sections of track which have been passed over and transfer them ahead. An excellent type of track for a heavy skid excavator operating on soft ground is described by D. W. O'Bannon in the *Excavating Engineer* for July, 1916.



DRAGLINE, MOST EFFICIENT WHEN BACKING AWAY FROM WORK, IS ESSENTIALLY A LAND MACHINE

The dragline machine has a marked advantage over other types in that it can handle a larger bucket for a given power unit than any other bucket dredge. Little if any lifting force is required while the bucket is filling, and the power for loading is applied in nearly a direct line from the winding drum, thus making it possible to exert practically the entire power of the engine in filling and cutting through obstructions. The dragline embodies many of the advantages of both grab-bucket and dipper dredges, with some of their disadvantages, as well as some peculiar to itself. It can dig around a stump in much the same manner, though not so well, as an orange-peel and can bring great power to bear at a single point in an effort to overturn the stump. Large stumps cannot be lifted clear of the pit without the use of chains, and in making an extra hard pull there is always present the danger of overturning the machine or of pulling it from its supports.

These machines will handle almost any material that can be excavated by a dipper dredge. They are not well adapted for digging soft material which washes easily. The stirring action is much the same as that of the dipper dredge and the bucket is not so well able to retain the material. Observation of a dragline machine engaged in excavating material deposited by a sluggish current in an old canal showed that the bucket was taking out only about 30 per cent of its rated capacity at each load. In suitable material, however, it will load considerably beyond the rated capacity. Under skillful manipulation a dragline machine is capable of dressing off a levee much better than can be done by any other type of bucket machine.

Hydraulic Dredges Preferred for Filling Low Land

Hydraulic dredges are often preferred for interior canal construction on account of their ability to spread the excavated material over a wide area, thus avoiding wasteful and unsightly banks. They are not often used for levee building on reclamation projects, though they have been so employed with good results. The preferred method in cutting new canals is to make a first cut with a small bucket dredge, dumping the material in about equal quantities on either side, to form a barrier which prevents the material excavated by the hydraulic dredge from flowing back into the canal. In other cases a small hand-built levee serves the same purpose. A levee or ridge of sod 2 ft. in height will usually retain the discharge from a 12-in. hydraulic dredge, provided the point of discharge is 30 ft. or more beyond the levee. For canals having a section much in excess of 10 yd. per linear foot a larger levee will be required.

Suction dredges are subject to delays through the stoppage of suction pipes and pumps from grass, roots and other débris, though the larger sizes are seldom troubled by anything smaller than stumps. Nothing less than a 10-in. pump should be used for work of this class, owing to frequent stoppage of the suction line, while the very large sizes are usually unsuitable because they require so large a hull that they cannot be used in the smaller canals. A 12-in. dredging pump with all necessary equipment can be mounted on a barge 24x80 ft., which will be found suitable for digging 30-ft. canals—a common size for the smaller systems. A 12-in. pump, equipped with a suitable cutter, will pass a surprising amount of solid articles. In cleaning out the Chalmette slips below the city of New Orleans a solid cannon ball from the Chalmette battlefield, pieces of ship's rigging and various other bric-à-brac were brought out by the suction dredges.

Types of Cutters Adapted to Different Materials

The greatest variation in these dredges is found in their cutter heads, their design and speed of rotation being dictated by the character of the material excavated. In hard, gravelly material a rugged cutter head is required which will produce the maximum agitation in the material. In the muck and soft clay soils of the lower Mississippi delta, on the other hand, a slicing action of the blades secures better results, especially if combined with only moderate speed of rotation. The cutter head shown in the illustration, made by the Ellicott Machine Company, is well adapted to a wide range of material. For soft muck, however, it would be greatly improved by reducing the section of the blades, thus increasing the clearance between them, and by lengthening the "basket" along the axis of the shaft. This would produce a less rugged head, but one which, if revolved slowly, would bring the soft muck to the suction with less breaking up of the material.

Expert Handling Prevents Clogging

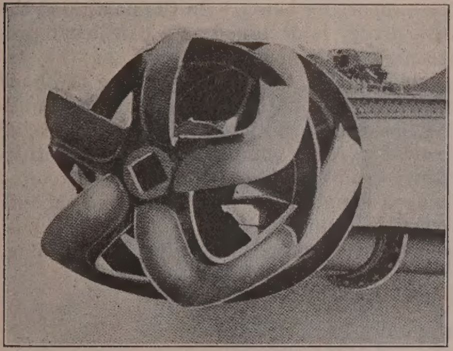
In the construction of wide canals or basins the ladder which supports the suction pipe and cutter head may be rigid laterally, but for the excavation of narrow canals a ladder is required which is flexible in all directions, as the space is too limited for keeping the intake to its work by swinging the hull. The swinging device should be subject to the easy control of the operator in order that the greatest economy of operation may be assured. The effective work of a hydraulic dredge depends to a great extent on the percentage of solids discharged. This percentage will drop with a dull, sickening thud if the dredge is operated carelessly or if it is not equipped so that the cutter head may be kept close up to the work and so regulated that it will not clog. In deep excavations care must be used to prevent undercutting to such an extent that heavy material can drop down onto the ladder and cutter head and choke the pump or wreck the end of the ladder.

Hydraulic dredges for canal excavation should be equipped so that they will discharge normally through a Y connection on both sides of the canal. The point of discharge should be not less than 50 ft. beyond the side of the hull, the pipes being supported by gallows frames or A-frames with cables. Each discharge should be equipped with a valve so that it can be closed temporarily for passing obstructions or intersecting canals. Where growing crops or other improvements do not prohibit the discharge of water and mud over adjacent lands hydraulic dredges are preferred to any other type for cleaning out old canals which have lost much of their original section through sedimentation.

Suction dredges may handle stumps by first undermining and then dragging them out with a line from a winch head on board the dredge. Although stumps may be taken out in this manner this type of dredge cannot be operated economically in a heavily timbered area.

Most of the power problems in dredge operation and design are common to all the classes of equipment described. Heretofore steam power has been used almost exclusively, the smaller dredges being equipped with the simplest type of slide-valve hoisting engines. Hydraulic dredges have usually employed a better grade of engine in their main power unit.

Great difficulty is experienced near the coast in securing suitable boiler-feed water. The unlimited use of raw water from the canals results in expensive delays and repair bills through the rapid deterioration of boilers, steam piping and engines. This trouble is reduced, though not eliminated, by the use of condensers. A dredge equipped with a complete salt-water outfit, including condenser, circulating and vacuum pump and a high-speed evaporator, was constructed by the writer in one instance for use in waters which were exceptionally bad. This plant has now been in nearly continuous operation for three years with no serious delays from the steam end of the outfit. Although the steam auxiliaries cost nearly the same as the boiler itself, it appears by comparing the operation of this dredge with that of others operating in the same water, but not similarly equipped, that the extra equipment has paid for itself several times over.



CUTTER SUITED TO WIDE RANGE OF MATERIALS

The intermittent but frequently excessive demands for steam on most types of dredges makes it necessary that an ample capacity for producing dry steam should be provided. Condensers, evaporators and steam separators are an aid, but nothing will fully make up for a deficiency in boiler capacity. Foaming, due to overcrowding the boilers, especially when supplied with poor water, reduces the available power of engines, carries away the lubrication and contributes to a large extent to engine breakdowns.

SHORT STACKS A DISADVANTAGE

Another factor in limiting the power supply is curtailment of draft through the unnecessary abbreviation of the stack. There is no reason why the average floating dredge should not carry a smokestack more nearly approximating the length established as good practice in other lines of steam engineering. In spite of this fact it is not uncommon to see an 80 or 100-hp. dredge boiler supplied with a 20-ft. stack. The design of the stack, however, should be based on the coal burned per hour rather than on the rated horsepower of the boiler, which should be considerably in excess of the theoretical requirements.

The accompanying table illustrates the writer's ideas as to suitable proportions for a 1½-yd. orange-peel, gravity-swing dredge designed for a given reach of 50 ft. from the side of the excavation. These proportions contemplate setting the machinery down in the hull. If set on deck, it would be advisable to increase the diameter of stack to 30 in. and reduce the height to 40 ft. Such an outfit should operate on about 300 lb. of coal per hour.

SUITABLE PROPORTIONS FOR 1½-YARD ORANGE-PEEL DREDGE WITH 50-FOOT REACH

Width of hull	36 ft.
Length of hull	80 ft.
Depth of hull	6 ft.
Length of boom	75 ft.
Spread of main drums	16 ft.
Double-cylinder main engine	10x12 in.
Boiler	80 hp.
Diameter of stack	27 in.
Height of stack	50 ft.

The lack of suitable boiler-feed water and the difficulty of transporting fuel and supplies to their plants have caused many dredge owners to consider the use of internal combustion engines in the place of steam power. The high price of gasoline makes this unavailable as a dredge fuel, but recently-developed engines operating on low grades of kerosene, distillate and even crude oil are now generating power for practically all purposes and are being used to a limited extent on dredges. These engines lack the flexibility of the steam plant and their use on dredges requiring numerous simultaneous operations presents serious difficulties. It is believed, however, that these will be overcome. In large plants the result will doubtless be secured by the use of a single or double power unit driving a generator which will furnish current for the individual motors used to drive each portion of the mechanism. The experience already gained in the operation of electrically equipped dredges in other sections will be of value in this development.

CONSTANT-SPEED ENGINES SATISFACTORY

Gravity swing dredges may be operated satisfactorily by single, constant-speed engines, the speed of hoisting lines and other operations being regulated by the slipping of friction clutches. The control of hoisting speed by the slipping of frictions is considered by many as wasteful and unsatisfactory, but with a properly designed device it has been found satisfactory, especially on machines of moderate size. For such service, the friction blocks should be of generous dimensions and turned true so that there will be complete contact over a large area. Maple seems to be preferred for friction blocks by manufacturers of dredging and hoisting machinery, but the writer has secured better results at a smaller cost by using well-seasoned black gum. Any good pattern maker can turn out a satisfactory set of blocks if given an accurate set of drawings to work from. A small gravity swing dredge has been operated from a constant-speed, internal-combustion engine for a period of over three months without renewal of the black gum friction blocks used in controlling the main hoisting drums.

Mileage Used as Basis for Computing Depreciation

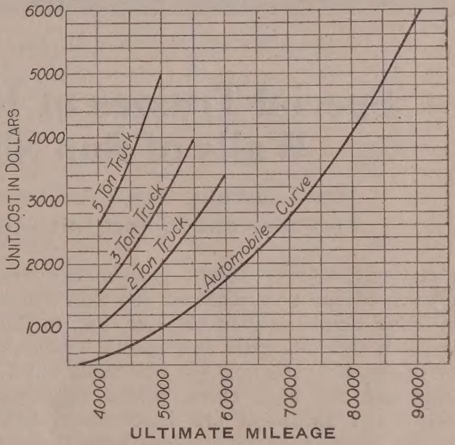
Value of Automobiles and Motor Trucks of Given Cost and Size Written Off at Rate Based on Probable Mileage

By ASA E. PHILLIPS
Superintendent, Sewer Department,
Washington, D. C.

THE SUBSTITUTION of a mileage basis for the time-of-service basis heretofore used has been suggested by the writer for determining the average approximate depreciation of municipally owned automobiles and trucks of various makes. The plan is intended to be used only for the purpose of equipment valuation. It requires, of course, some simple and approximate rule for determining what may be called the ultimate mileage, or that mileage beyond which considerable renewals, reconstruction or entire replacement would theoretically be necessary. With machines of various makes, merits, types and costs, such a determination should have a uniform basis. Obviously, the most available is the single factor of initial cost.

EMPIRICAL FORMULAS DERIVED FROM DATA AVAILABLE

The automobiles and trucks owned by the District of Columbia are used chiefly on construction work and operate over an area of about 70 square miles. Only a comparatively small portion of this district has as yet smooth pavements, and the vehicles under consideration are operated largely in unimproved sections. The following simple empirical formulas, based on such data as are available, have been derived as a tentative solution of this vexatious problem of valuation:



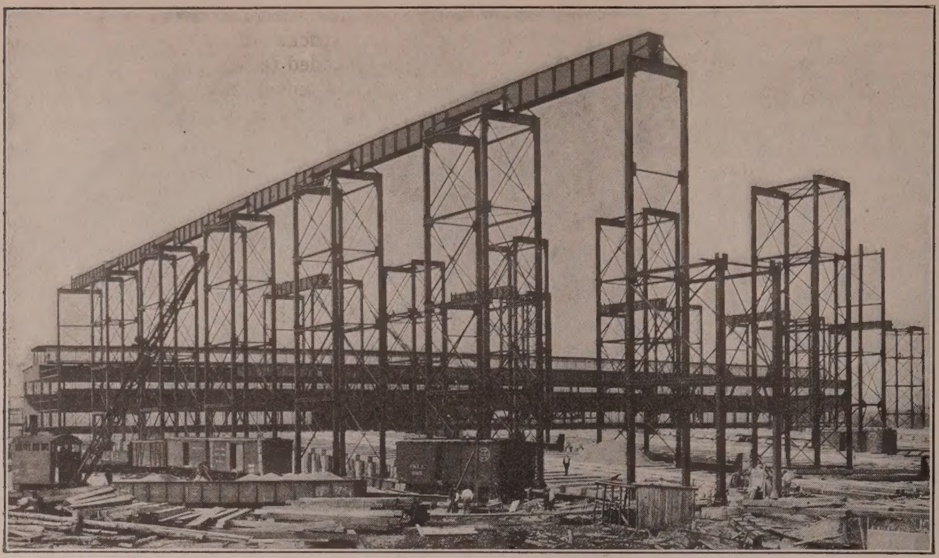
DEPRECIATION IN TERMS OF MILEAGE

For automobiles, $M = 5000\sqrt[3]{C}$;

For trucks, $M = 5000\sqrt[3]{\frac{C}{L}}$

$M =$ Ultimate mileage;
$C =$ Initial cost;
$L =$ Load capacity in tons.

Based on these formulas, the curves shown in the diagram indicate the ultimate mileage for automobiles costing from $300 to $5,000 and for trucks costing from $1,000 to $5,000. In the case of trucks it has been assumed that under service conditions the ultimate mileage varies inversely as some function of the load carried. In other words, it is assumed that a 3-ton truck of the same initial cost would probably have less mileage than a 2-ton truck, other conditions being equal. These formulas, of course, should be used only for the purpose for which they were derived, and can in no sense be relied on to give a measure of relative values. Possibly, however, they may have a somewhat wider application in the way of determining the mileage which should be realized from reconstruction and replacement, and might be made to serve as an indication of the economic expediency of such an investment. So much depends, however, on the condition of roads and on the care, good sense and judgment of operation that the question of the actual ultimate mileage of such vehicles is beyond any possible statement.



CRANE RUNWAYS 95 FEET HIGH AND 600 FEET LONG ON 15 x 25-FOOT TOWERS

Special Trusses of Rolled Beams Used in Walls of Sun Shipbuilding Plant

Five Launching Ways Are Served by Ten 15-Ton Cranes of 112-Foot Span and 95-Foot Lift—Runways Cantilevered at Each End

SUPPLEMENTING the general description of the new plant of the Sun Shipbuilding Company near Chester, Pa., in the issue of Oct. 21, page 498, special features of the steel framework of the main buildings and the high crane girder supports above the shipways are here illustrated. Heavy trusses built of Bethlehem beams with connections for runway beams, roof columns, rafters and floor girders are used in the walls between the main parts of the buildings. As shown in the previous article, the main buildings are laid out as a large H in plan. At the junction between them overhead trusses span two 80-ft 6-in. openings and one 69-ft. opening corresponding to the bays of the fabricating shop, which is the cross-bar of the H.

The five sets of crane runways above the reinforced-concrete shipways are supported upon high towers 15 x 25 ft. in plan, with girder beams for the vertical columns. In fact, this type of rolled section was used for columns throughout the buildings. The heavy columns required to support the above-mentioned trusses between the buildings are 30-in. 200-lb. Bethlehem girder beams.

TYPICAL DETAILS OF TRUSS

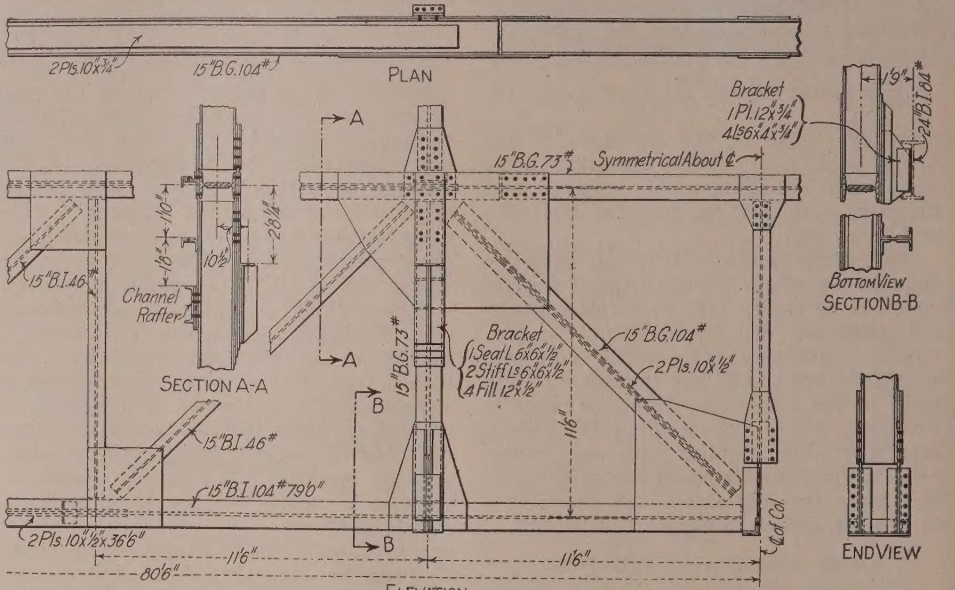
The latticed girders or Pratt trusses spanning the openings between the laying-out shop and the fabricating shop are designed to give 20-ft. clearance. They carry the roof columns of the outside buildings, the sloping rafter for the roof of the fabricating shop, the plate girders supporting the mold-loft floor, and the 5-ton crane runway beams in the laying-out shop. As indicated by the typical details here reproduced, these trusses are built of 15-in. Bethlehem beams and girders, making the connections for the attached parts relatively simple. It will be seen that the top-chord member is made continuous across the columns between adjacent trusses, introducing continuity of action, which, however, was not considered in computing the stresses, but it was done to give additional stiffness.

The total weight of these heavy trusses is 21 tons for the 80-ft. 6-in. spans and 16 tons for the 69-ft. spans. They were detailed with ½-in. gusset plates and ⅞-in. rivets.

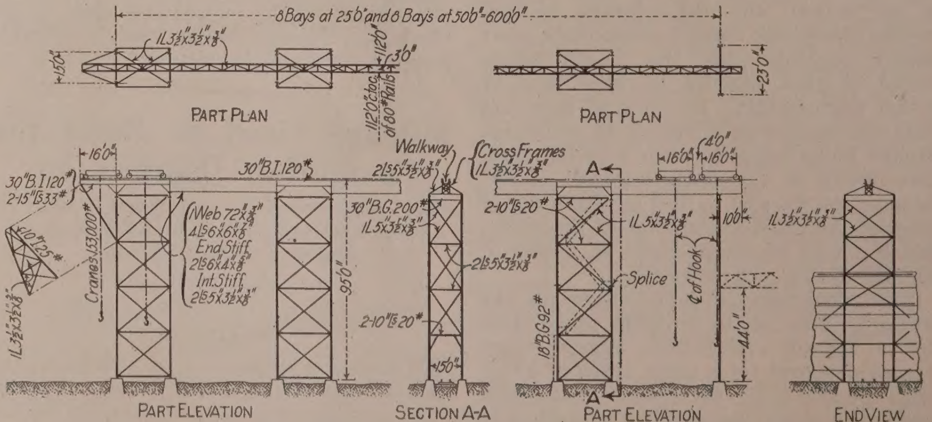
The five launching ways to the south of the assembling shop are served by overhead bridge cranes, two in each aisle, of 15-ton capacity, 112-ft. span and 95-ft. lift. The total 600-ft. length consists of eight alternate 25-ft. and 50-ft. bays, with towers designed as shown in one of the drawings. The runway beams are 3 ft. apart, braced by angle bracing and cross-frames, as indicated in the plan and end views. The main girders are 6 ft. deep and the tower spans are 30-in. I-beams. Transverse 30-in. 200-lb. girder beams carry the loads to the columns.

Diagonal bracing of single angles is used on all sides except for the lower panel in the transverse planes, where a portal is required to allow clearance above the railroad track passing through the towers. Horizontal bracing is provided at each panel point. In the design 25 per cent was added to crane-load stresses to allow for impact.

At each end the runways project beyond the supporting bents. On the north end the 6-ft. girder is designed as a cantilever projecting 10 ft. over the roof of the assembling shop, thereby permitting the hook of the end crane to fall close to the building. On the south, or river, end special runway girders composed of 30-in. Bethlehem I-beams with a 15-in. channel riveted to each flange project 16 ft. beyond the end tower, bringing the hook over the stern post and rudder frame of the ship. Braced diag-



TYPICAL DETAILS OF 80-FOOT 6-INCH TRUSS BETWEEN MAIN BUILDINGS

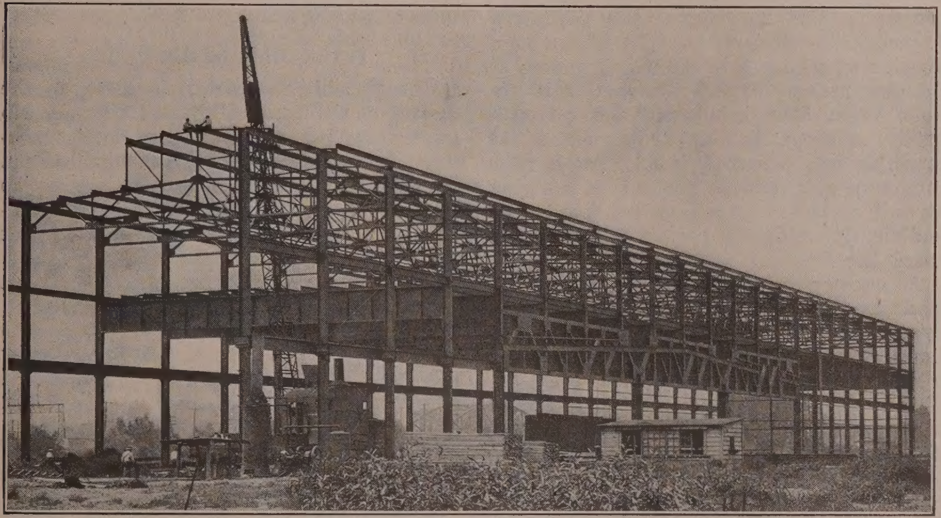


BRACED TOWERS SUPPORT CRANE GIRDERS ABOVE LAUNCHING WAYS onal struts support this end, as shown, by a connection to the tower panel point below.

10,000 SQUARE FEET OF SLIDING DOORS

About 10,000 sq. ft. of sliding doors are required, consisting principally of five large doors, 23 ft. wide and 38 ft. high, opposite the shipways, permitting complete bulkheads to be removed from the assembly shop to the shipways.

Among the other features in these large buildings may be mentioned the rubberoid roofing used on 2-in. sheathing and 12-in. channel purlins for the roofs; the continuous bands of solid rolled-steel Fenestra wall sash (with 30-per cent ventilation in the walls and 50-per cent ventilation in the monitors), giving 80,000 sq. ft. of glazing out of the total 170,000 sq. ft. of side walls, or 47 per cent; the design of the roof trusses in the fabricating shop to carry concentrated loads of 3 tons at any panel point to provide for future monorails, with 12-in. I-beams for attachment as required, and the use of minimum-size angles of 3 x 2½ x 5/16. About 6000 tons of structural steelwork was erected in four months by two 30-ton industrial cranes equipped with 85-ft. booms and 15-ft. outriggers.



HEAVY TRUSSES AT CONNECTION OF LAYING-OUT SHOP WITH FABRICATING SHOP

All the main buildings were designed by the engineering department of the Belmont Iron Works of Philadelphia, of which J. G. Shryock is designing engineer. The steel was fabricated at their Eddystone bridge shop, of which A. F. Rader is superintendent. The erection work was done by their erection department, of which B. T. Mial is manager. All details were subject to the supervision and approval of the Sun Shipbuilding Company, of which J. Howard Pew is president and J. N. Pew, Jr., vice-president.

Painted Curbs Warning Signals

By ordinance many cities specify that vehicles may not stand within a certain distance of a fire hydrant. In San Bernardino, Cal., it is 15 ft., and as a reminder the fire chief has had the hydrant curb painted red. In addition in white letters are stenciled the words "Keep Away." In some of the outlying districts of Chicago the curb opposite catchbasins has been painted red, presumably for the purpose of quick location should the sewer clog and flood a large area of the adjacent pavement. Following a heavy snowfall the location will be facilitated, as gutter plows will uncover the curb.

Railroads Involved Protest Against First Two Tentative Valuation Reports

Atlanta, Birmingham & Atlantic and Texas Midland Take Exception to Many Features of Findings of Interstate Commerce Commission

PROTESTS are made by the Atlanta, Birmingham & Atlantic Railway on fifty-six counts and by the Texas Midland Railroad on twenty-eight against the tentative valuations of those roads reported in October by the Interstate Commerce Commission. In the main, these protests are along the line of the arguments presented by the carriers at the various valuation conferences that have taken place in Washington, and could have readily been predicted. Features of them are here presented, however, as they relate to the first two railroads reported on by the commission. (Abstracts of the reports were published in the Engineering Record of Nov. 11, page 598.) The two protests have been published and distributed among the carriers by the general secretary of the Presidents' Conference Committee, Thomas W. Hulme, Philadelphia. The Atlanta, Birmingham & Atlantic brief contains fifty-nine pages, and is signed by E. T. Lamb, president; that of the Texas Midland contains forty-three pages, and is signed by L. W. Wells, assistant to the general manager and chief engineer. It may be noted that where the commission allows $24,154,998 for the reproduction cost, exclusive of land, of the Atlanta, Birmingham & Atlantic, the carrier claims $39,079,260.74.

Atlanta, Birmingham & Atlantic

Exception was first taken by the Atlanta, Birmingham & Atlantic to the capital liabilities reported—$59,565,176. Mr. Lamb admits that the figure was correct for June 30, 1914, the date of valuation (when the property was under a receivership), but points out that by the reorganization of Dec. 31, 1915, the capitalization was reduced to $39,290,000 par value. He points out further that since the reorganization gross revenues have increased, transportation expenses have decreased and the company has acquired a large cash balance. He contends therefore that a tentative valuation not completed until Oct. 19, 1916, and given to the public on that date, which does not direct attention to the changes in ownership, the reduction of outstanding capital liabilities and the increase of earnings, all prior to Oct. 19, 1916, is misleading, and is calculated to affect the carrier injuriously.

Complete omission is charged of various elements of property used but not owned by the carrier. Among these are the passenger stations at Atlanta and Birmingham.

MANY ARBITRARY ASSUMPTIONS CHANGED

Objection is raised to numerous so-called arbitrary assumptions. These include assumptions that certain lands actually acquired and held for carrier purposes were not so acquired and held, the assumption having been made without consultation with the carrier; that in reproduction right-of-way and terminal lands will be ready on the date construction begins, without the necessity of a prior purchase and expenditure upon which interest will accumulate; that when the physical parts of a railroad have been connected for initial operation the construction is complete, and no other construction expense will be necessary; that in reproduction there will be no depreciation in engineering costs but will be depreciation in labor costs, and in taxes, interest and all other overhead costs. "It is assumed," states the protest, "that as to certain physical properties only cost figures are to be ascertained and reported, and that as to certain other properties, such as land, only figures of value are to be ascertained and reported, and that as to depreciation the same is to be ascertained and reported in terms of 'value' and that by a combination of these several figures of 'cost' and 'value' a sane and intelligible result of the 'value' of all the property and its 'cost of reproduction' may be determined."

Regarding aids, gifts, grants of right-of-way and donations, protest is made against the placing of land in that category merely because the consideration named in the deed was nominal. Attention is called to an alleged donation in the town of La Grange, where, as a matter of fact, the protest states, the grant was the result of a valid contract giving the town a substantial concession in the matter of rates from the East, which concession has cost, is now costing and will continue to cost the carrier a substantial sum of money.

WORKING CAPITAL OMITTED

Working capital, Mr. Lamb finds, is omitted in the tentative valuation, although it appears in the accounting report that on June 30, 1914, the carrier had a total of current assets, including cash on hand, amounting to $1,576,359.74. The carrier protests that there should be included in the cost of reproduction a sum for working capital not less than $200,000.

The protest holds it inconsistent to make no allowance for development expenses, while nevertheless reporting a net loss amounting to $4,446,095.25, some part of which loss, the brief states, was undeniably incurred in developing the property. The carrier claims under this heading a sum of not less than $2,500,000.

The commission's engineering report is

asserted to be in error in assuming that in reproduction the bulk of construction material would be delivered by construction trains. In the mountainous regions it is protested that this would be impossible.

Interest During Construction

Where the commission allows $1,215,737 for interest during construction, the carrier claims $3,183,446. The carrier protests that the construction period assumed should be from 36 to 60 months instead of from 18 to 36, that not less than 6 per cent per annum interest should be allowed and that to this should be added an allowance for discounts and commissions. As to all other overhead items the figures the carrier claims are based on the same percentages as those used by the commission, applied to the figures of the various roadway and equipment accounts increased to the amounts claimed by the carrier.

Table 1—Allowance of Commission and Allowances Claimed by Atlanta, Birmingham & Atlantic for Various Items

Class	Commission	Carrier
Road:		
Engineering	$589,503	$1,004,426
Grading	5,263,885	6,992,993
Trestles and culverts	2,370,728	2,985,590
Ties	999,281	1,366,408
Rails	2,717,804	3,023,265
Ballast	381,770	830,340
Track laying and surfacing	716,765	1,210,489
Equipment:		
Steam locomotives	1,263,647	1,353,362
Freight-train cars	2,895,376	3,065,254
Passenger-train cars	399,780	488,930
General expenditures:		
Interest during construction	1,215,737	3,183,446
Total	$22,546,132	$30,058,370
Georgia Terminal Company	903,270	1,442,256
Alabama Terminal Railroad	705,596	897,252
Grand Total	$24,154,998	$32.397,878

Table 2—Additional Allowances Claimed by Atlanta, Birmingham & Atlantic

Abandoned property	$210,000.00
Development cost	2,500,000.00
Appreciation	1,250,000.00
Current assets, including working capital and materials and supplies	1,576,359.74
Telegraph property	123,709.00
Property leased to Woodward Iron Company	1,021,314.00
Total	$6,681,382.74

The commission allowance of $589,503 for engineering in the case of the Atlanta, Birmingham & Atlantic proper the carrier considers grossly inadequate. The carrier protests that this amount should be not less than $1,400,426. It contends that the allowance for engineering should be not less than 5 per cent of roadway and equipment accounts 3 to 47, exclusive of accounts 39, 40 and 41. The carrier protests that the amounts allowed for engineering in the case of the terminal companies are also grossly inadequate.

Abandoned Property

To support his contention that much abandoned property should be included in reproduction cost, Mr. Lamb cites the case of the Eastern Railway of Alabama. Here was a 20-mile line which interfered materially with the proposed line of the carrier, and rather than construct an entirely new line avoiding the existing road it was found cheaper to buy the existing road, utilize 8.3 of the 20 miles and abandon the remainder. The line cost $429,000, and the total salvage did not exceed $229,000. The carrier claims therefore an allowance of $200,000 at this point under the heading of abandoned property.

These are only a few of the company's criticisms of the commission's treatment of the road, equipment and general-expenditure accounts. The carrier also enumerates a long list of items omitted entirely, these including contingencies, assessments for public improvements, overhead crossings actually paid for, engineering and reconnaissance expenses in preliminary and location surveys, excess cost of maintenance and operation before track and roadbed have seasoned, franchises, appreciation, maps and plans, and time tables, car schedules, tickets and many other materials that would have to be purchased as part of the investment in advance of earnings. The commission is held to be in error in failing to show "other values or elements of values." The carrier disagrees absolutely with the commission's interpretation of depreciation, but complains in addition that because the commission's report does not set forth the basis for the depreciation deduction, and because, furthermore, the government's field men have been permitted to modify the declared practice of the commission as set forth in the memorandum of the Engineering Board, the carrier is unable, when dissatisfied with an estimate made, to show that any rule, method or principle was departed from. The carrier complains also that the methods of arriving at unit costs have not been set forth fully and clearly enough to permit the carrier to check the figures.

A comparison between the allowances made by the commission and those claimed by the carrier for some of the principal items is afforded by Table 1. The grand total allowed by the commission, exclusive of land, is $24,154,998. The total of the corresponding items as figured by the carrier is $32,397,878. In addition to this, however, the carrier claims the items shown in Table 2, for which the commission makes no allowance. They total $6,681,382.74, bringing the grand total, exclusive of land, to $39,079,260.74.

Treatment of Land Protested

Coming down to land, the carrier protests against the giving of land a different treatment from that given the other physical properties of the carrier. It protests that with "present value" shown as it has been for land, while for all other physical properties only cost figures are reported, it is impossible to determine the total cost of reproducing all the physical properties of the carrier owned or used by it for its purposes as a common carrier, or to determine the present value of the same. The carrier protests that in order to determine either the present value of all the physical properties or the cost of reproducing same, all of them, including land, must be treated alike, and either the present value or the cost of reproducing must be stated after each piece of such physical properties.

The carrier protests that inasmuch as the commission's land report states that "the fair market value of similar adjoining or adjacent lands was ascertained, and the unit of value of such lands constituted the value which was applied to the zones of the carrier's lands," the figures reported do not state the true present value of the lands, and are meaningless and worthless for any purpose. As instances where the so-called "present value" is considerably less than the amount actually paid, the brief cites one parcel given a "present value" of $3,843.75 that actually cost the company $39,992.17 and another given a present value of $20,775 that actually cost $40,658.43. The carrier protests that in the absence of evidence showing that it was reckless or improvident in prices paid for lands, it cannot be allowed, in determining the cost of reproduction of its property, a less amount than it actually paid.

Further protest is made that certain lands have been classed as non-carrier lands that were acquired for carrier purposes and are now so held, and that in acquiring and holding such lands for carrier purposes it has acted reasonably and prudently and with good judgment.

As compared with the "present value" of $2,291,413 allowed by the commission, the carrier claims a cost of reproduction on the valuation date, exclusive of interest, of not less than $8,192,369. In addition to this it is contended that interest should be allowed on its lands at 6 per cent per annum for from two to four years, amounting to a total of $1,860,329.

Texas Midland Railroad

Considerably less detail is given in the protest of the Texas Midland Railroad. No figures are presented to show what reproduction cost totals the carrier would claim. In general, the arguments are similar to those of the Atlanta, Birmingham & Atlantic. The carrier does, however, present claims of unit prices considerably in excess of those allowed by the commission. Some of the comparative figures are presented in Table 3. The carrier also asserts that 14 miles of railroad under joint use with another company were omitted entirely from the tentative valuation.

Table 3—Comparative Unit Prices Allowed by Commission and Claimed by Texas Midland Railroad

Account	Commission	Carrier
Earth excavation, cu. yd.	$0.15	$0.18
Earth embankment, cu. yd.	.135	.18
Hardpan	.24	.35
Loose rock, cu. yd.	.35	.43
Solid rock, cu. yd.	.67	.97
Pile trestles, lin. ft.	11.80	20.00
Concrete, cu. yd.	$8.90 to 11.80	*15.00
Ballast, sand, cu. yd.	.15	.36
Ballast, stone, cu. yd.	.65	.80
Tracklaying and surfacing:		
Ballasted track, mile	780.00	1,185.00
Installing turnouts, each	20.00	50.00

*Only 1118 cu yd. of concrete in all.

Five Cities Now Operating Home-Made Alum Plants

Highly basic aluminum sulphate as a coagulant for water purification is now being made by plants on the ground in five cities—Columbus, Ohio; Trenton, N. J.; Springfield, Mass.; Omaha, Neb., and Montreal Canada. In addition a private plant is being operated at the factory of the Independent Packers Fertilizers Company, Columbus, from which a number of water plants have been supplied with the alum cake in which 10 to 14 per cent of the aluminum content is basic. C. P. Hoover, chemist in charge of the Columbus water softening and purification plant, recently was granted patent 1,197,123 on this process of purifying water. One of his main claims is that this highly basic alumina being less stable than the acid combined alumina dissociates quickly. Hence there result a quick coagulation, large flocks and quick sedimentation. This is considered of particular advantage in treating cold water, as ordinarily the reactions in it are slow.

Timber-Incased Concrete Caisson to Be Sunk 142 Feet for New London Bridge

Jets Opening Outside as Well as Under Cutting Edge to Guide High Boxes—Three Air Caissons and Two Cofferdam Abutments in Contract

TIMBER-INCASED concrete caissons sunk by open dredging to depths beyond the reach of the pneumatic process feature the construction of the new Thames River Bridge of the New York, New Haven & Hartford Railroad at New London, Conn. In sinking these caissons, 30 x 94 and 42 x 99 ft. in plan, to depths of 110 and 142 ft. below mean low tide level, an extensive system of jets, arranged to loosen the material beneath and to play a film of water up any one or all of the four outside faces, is being used to guide them down in correct position. Requiring some 3,000,000 ft. b.m., these piers represent an unusual consumption of structural timber for a single bridge project.

Besides the three dredged caissons, two abutments are being built in cofferdam, and the fourth pier will be sunk by the pneumatic process. As the rock ledge dips about 40 ft. in the length of this pier, three cylinder piers will be sunk to support it instead of sinking a full-size caisson. This will greatly reduce the rock excavation under air. Except the compressor plant for these caissons and the plant at the shipyard where the caissons are built, the work is being carried out largely with floating equipment, including an unusual concrete barge, described on page 752 of this issue.

WOOD AND CONCRETE CAISSONS

The three caissons to be sunk by open dredging have cutting edges of steel filled with concrete, not only under the outside walls, but also under the center wall and cross-walls between the dredging pockets. This construction will give greater bearing in going down and reduce the stresses from possible uneven support. It also makes possible the use of heavier concrete walls between the dredge wells. The lift pier caisson has a longitudinal wall of reinforced concrete, while the two narrow caissons have timber center walls 3 ft. thick. The reinforced-concrete walls surrounding the dredge wells give a strength and stiffness unattainable with an all-timber structure, while the use of timber for outside walls and dredge wells gives greater ease and flexibility of construction after floating than with an all-concrete structure. With the latter, concrete must be kept above water; while with the caisson designed, the top of concrete is below water during the entire sinking, and it is not expected that extra weight will be needed. The pier shafts themselves will be started 30 ft. below mean low water.

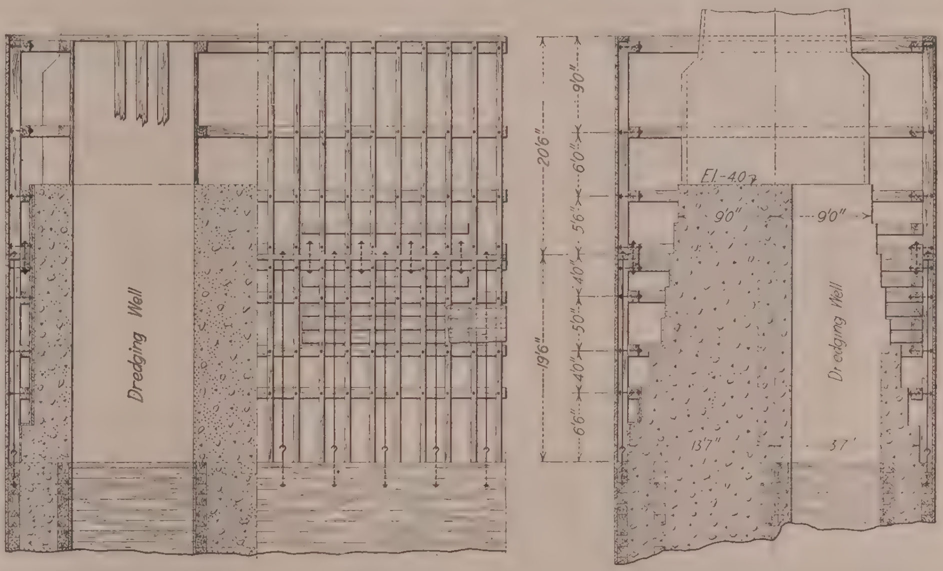
CAISSON LAUNCHED FROM MARINE RAILWAY

The contractors leased a marine railway of 2500-ton capacity on the west bank of the Thames a mile above the site. Here the caissons for piers 1 and 2 have been begun and launched and that for pier 3 is being built. The cutting edges are assembled on a false bottom resting on the ways and the timber work is carried up about eight courses. The concrete is then placed in the cutting edges and up to a depth of one course in the cribwork. A mixer at the center of the north side of the ways is supplied by a track to the end of a pier north of the ways, where sand and gravel are received in scows. Cement is delivered on a siding from the Central Vermont Railroad. The concrete is placed by a derrick, which is also used to set the steel and timber.

With the caisson concrete above the lower course of timber the ways are lowered down the railway till the structure floats and can be towed to the site. The timber for the first buildup is delivered and framed at the north side of the ways, where a power saw is located. The rest of the timber is delivered and framed in the north end of the shipyard. Here it is rolled into the water, rafted by courses, and towed to the bridge by gasoline launches.

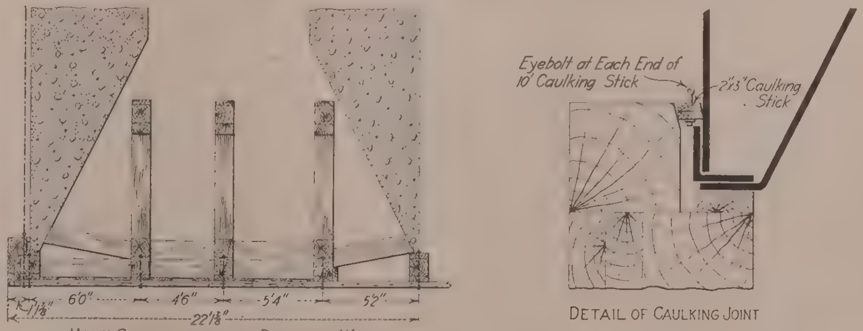
SECOND BUILDUP PLACED BEFORE REMOVING FALSE BOTTOM

For placing the second buildup the caissons have been tied up successively to the north end of the fender pier for the present drawspan, where an air compressor and a boiler for running the air boring machines and drift-pin hammers are installed. With a derrick boat alongside to place the timbers, the caissons are built up as high as they can float and still permit the removal of the false bottom. The dredging wells are then filled with water to river level, thus relieving the pressure on the false bottom, and enough gravel is dumped into the dredging wells to overcome the buoyancy of the false bottom. About 80 yd. was required for the first



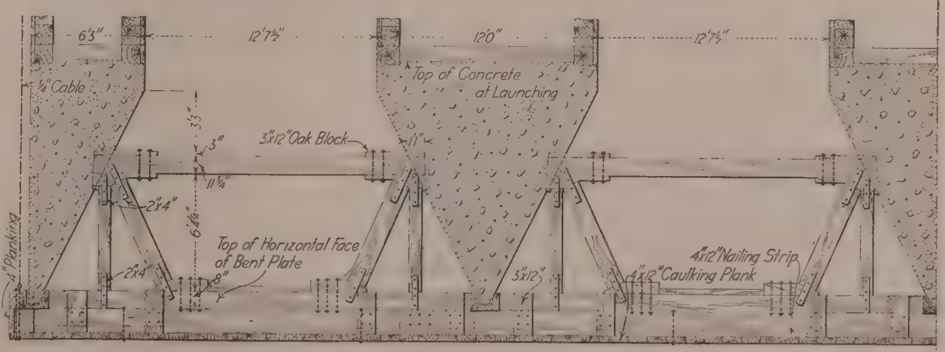
LONGITUDINAL SECTION SIDE VIEW CELL SECTION WELL SECTION

TIMBER AND CONCRETE DESIGN OF CAISSONS GIVES GREAT FLEXIBILITY IN CONSTRUCTION



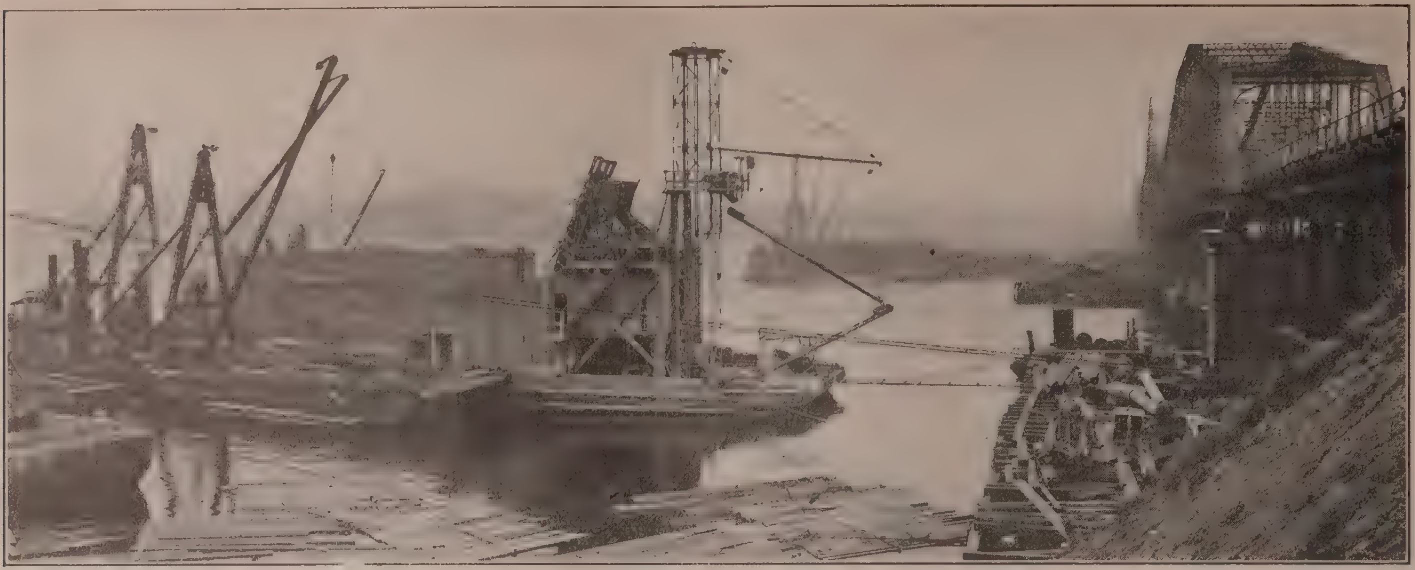
HALF SECTION THROUGH DREDGING WELL

DETAIL OF CAULKING JOINT



PART LONGITUDINAL SECTION THROUGH DREDGING WELLS

FALSE BOTTOM'S SEAL TO CAISSON BROKEN FOR REMOVAL BY PULLING OUT CALKING STICK



LARGE CAISSONS, SUNK TO UNUSUAL DEPTH BY OPEN DREDGING, WILL CARRY FOUR-TRACK STRUCTURE TO REPLACE BRIDGE AT RIGHT

Mixer boat and derrick barges between west abutment and pier 1 at left, large caisson tied to old fender pier in center and present bridge at right.

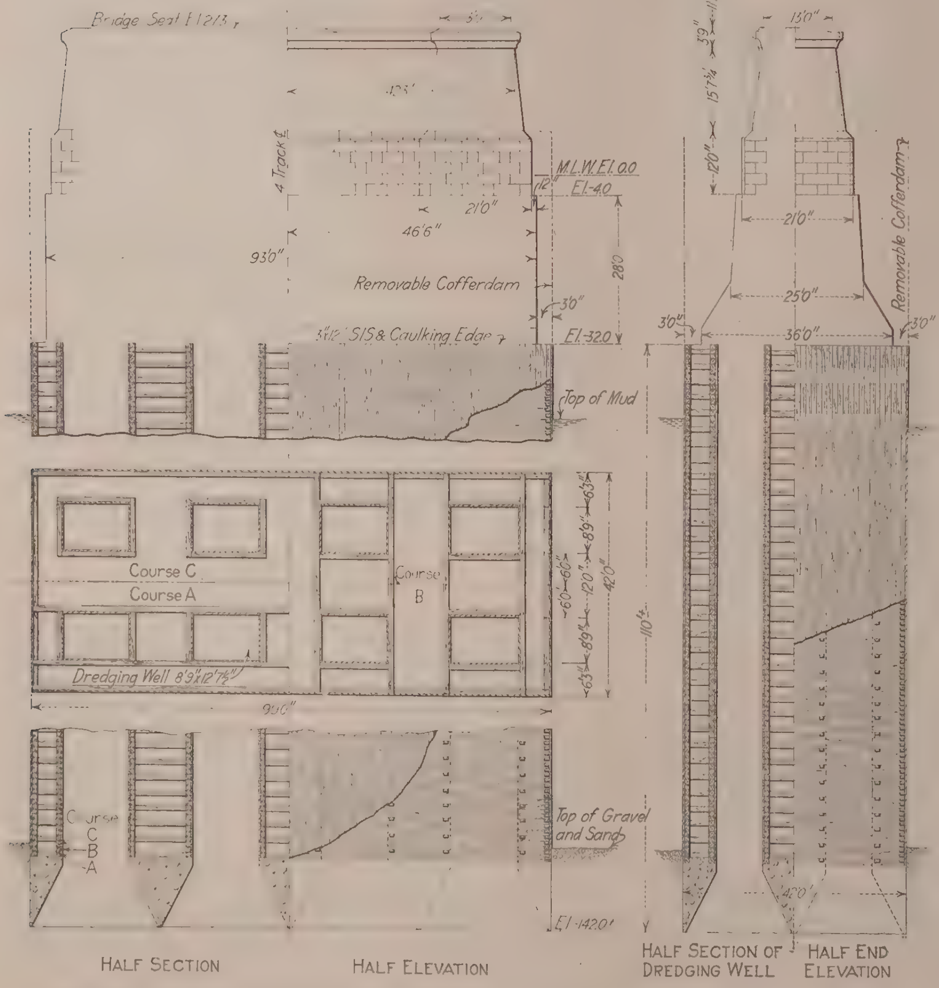
box. The bottom is recovered by lines attached to it before sinking. The caisson is then towed to place and set by water ballast in the buoyancy cells. Dredging is then begun, and dredging and concreting are continued till the top course nears high tide level.

When the bottom is removed, the caisson is floated by the air space above the concrete between the outer walls and the dredging-well walls. The pressure on the dredging-well walls, which are sheathed and calked, sprung the corners of the dredge wells in the first caisson and sunk it just after the bottom had been loosened. The caisson was raised by putting on another buildup and pumping it out.

When the first sinking is completed, a second buildup of timber, extending in the case of pier 1 clear to the top of the caisson section, is placed. A small air plant on a barge is used to supply the boring tools. This barge also supplies steam for the pumps used to unwater the space surrounding the dredge wells for concreting. With piers 2 and 3 sunk 32 ft. deeper than pier 1, a third buildup is necessary. Sinking is then resumed and carried on till it becomes necessary to place the removable cofferdam, inside which the pier shaft is to be built. Only one cofferdam, with four end and four side sections, is required. This is to be used successively for all three piers, extra panels being inserted for the large pier. A single set of ordinary bracing is provided for this dam, which will be removed as the masonry of each pier shaft is brought up and replaced by blocking. The cofferdam is secured by rods, reaching above water, to hook bolts in the top of the outside skin of each caisson. To release it, these rods are loosened and dropped till they are free of the hook bolts, when the bolts left above water to secure the sections to each other can be taken out, allowing the cofferdam to fall apart.

The dredge wells of the caissons are to be filled with mass concrete. They will probably be sealed under water and pumped out.

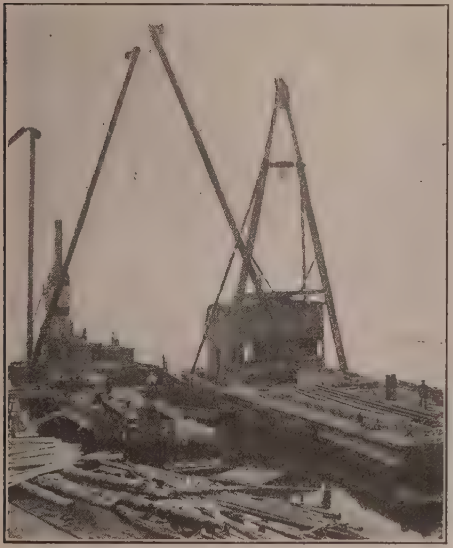
That most of the sinking will be through mud and very soft clay has been determined by careful soundings. Gravel in varying depths will be encountered toward the end, however, as all three of the dredged caissons will be landed on gravel. To wash out material and allow the caissons to move laterally in any desired direction, jet openings are provided on the outside of the cutting edge as well as on the bottom. The openings on the outside are of ¾ in. diameter, spaced about 8 ft. apart and 3 ft. 8 in. above the cutting edge. These jets, thirty-six in number, are arranged in six groups of six jets each—one group at each corner with three jets along the side and three on the end of the caisson; the last two groups have one jet along each side of the caisson. Each group of six is supplied with water at 150 lb. pressure through a 4-in. pipe line. Each of the eight dredge wells is provided with eight jets, two on each side of the well. Each well has two 4-in. pipe lines for its group of jets, the risers being located at diagonally opposite corners of



ONE REMOVABLE DAM, DETACHED BY PUSHING DOWN LONG RODS, USED FOR THREE PIERS the well. Large pumps mounted on a barge are used to operate the jets and if necessary sufficient capacity for supplying all the openings at once can be provided.

Air Caissons of Steel

The three caissons to be sunk by the pneumatic process for pier 4 will be 22-ft.-diameter cylinders with steel cutting edges and shafting and with wood-stave skins filled with concrete. They will be built and launched from the marine railway, towed to the site in turn and landed. Air will be used from the start of sinking, and about 45 lb. pressure will probably be needed before the deepest one is sealed. The air plant is being set upon the east shore back of the east abutment. A trestle to carry the air mains and a walk for the men will be built from the bank out to the pier. The Matheson locks used by the contractor are operated by independent hoists, which will be set on staging around the pier.



PULLING SHEETING AT WEST ABUTMENT

To allow the approach fills to be made the abutments are to be completed at an early date. The west abutment, the first work started in the river, is now above water and the single-row cofferdam of steel sheeting in which it has been constructed is being pulled for use on the east abutment. These abutments rest on concrete mats on gravel, from which three concrete piers rise to a point 13 ft. above low tide. Here they are capped by a reinforced-concrete bridge seat. On the water side riprap will be placed around these abutments to retain the earthfill inside and behind them.

Plant and Material Handling

Some gravel and all of the sand come by water from a pit on the Thames River above the site. This pit, however, runs too high in sand to supply all the gravel, most of which is brought up the sound from the neighborhood of New Haven. To avoid interruption to the work from foggy and stormy weather during the winter, a reserve of 4000 yd. of sand and double that quantity of stone is being accumulated on the east bank above the line of the approach fill. All the cement is received by rail and unloaded into a 20-car house south of the main line on the west bank. A belt conveyor carries cement from this house to a barge at the waterfront which is loaded with enough cement at a time for a 300-yd. run.

The concrete plant is mounted on a barge. It consists of a tower on one end and a derrick on the other, with sand and gravel storage on the deck between. It usually places more than 300 yd. in a 10-hour day. Aside from a derrick mounted back of the west abutment, the derricks at the shipyard and a locomotive crane used to handle the timber at the same place, six derrick boats are taking care of most of the work. A floating piledriver is used in cofferdam construction and three deck scows are required to handle cement and to float a small air plant and the jetting plant employed in building up and sinking the caissons. A gasoline towboat with a 55-hp. engine and a launch are kept in service.

Work was started in March, 1916. Up to a short time ago 800,000 ft. b.m. of timber, including all that is to be left in place, has been put on the caisson for the first pier, and sinking on this pier had been about three-fourths completed. The second pier caisson has been placed and the second buildup on it is under way. Work has been started on the upper part of the west abutment and on the cofferdam for the east abutment. The third and last dredging caisson is being constructed at the shipyard.

Very good deliveries of high-grade yellow pine have been secured. This timber, which three years ago would probably have been shipped by water, comes in by rail. Five hundred thousand feet of 3-in. sheeting alone, dressed with a calking edge at the mill, is included in the timber order.

The bridge substructure is being built by the Holbrook, Cabot & Rollins Corporation for the New York, New Haven & Hartford Railroad, of which Edward Gagel is chief engineer; W. H. Moore, engineer of structures; I. D. Waterman, engineer of construction. P. B. Spencer, division engineer at New London, is in direct charge of the improvement. The work is being handled from the Boston office of the contractors under the direction of J. W. Rollins, president of the firm. L. S. White is in charge of the work as superintendent.

Teach Engineering Students Fundamental Principles, Says Dr. D. S. Jacobus

Retiring President of American Society of Mechanical Engineers Discusses Needs of Educational Systems as They Now Exist

THAT a thorough mastery of the fundamental principles of engineering science, rather than the mere memorizing of definitions and formulas, is one of the greatest needs in the education of engineering students to-day was the keynote of the presidential address of Dr. D. S. Jacobus delivered at the annual meeting of the American Society of Mechanical Engineers in New York City last week. Dr. Jacobus believes that the elimination of much of the matter from present courses of engineering study and the more thorough teaching of what remains—particularly the writing of good English—will result in the production of graduates who will more nearly approach our ideals. In the remolding of college curricula he maintains that a closer coöperation should exist between college faculties and employers of engineering graduates and that engineering societies could do useful work "if they would go into the problem seriously." Commenting upon the qualities needed in successful engineers, as determined by the canvass of opinion made by the Carnegie Foundation for the Advancement of Teaching, the retiring president of the American Society of Mechanical Engineers conceded the importance of what may be termed the human characteristics, which occupy the upper positions on the list; but he pointed out the grave danger of belittling the requirements for technical knowledge, lack of which, he said, has led many a man to failure. Dr. Jacobus decries the tendency toward specialization along narrow lines, particularly in preparatory schools, and asserts that it is a mistake to aim at high technical requirements in college admission examinations. Extracts from his address follow:

Qualifications Analyzed

Let us analyze the factors in the Carnegie list as given in the order of importance indicated by the replies:

1. Character, integrity, responsibility, resourcefulness, initiative.
2. Judgment, common sense, scientific attitude, perspective.
3. Efficiency, thoroughness, accuracy, industry.
4. Understanding of men, executive ability.
5. Knowledge of the fundamentals of engineering science.
6. Technique of practice and of business.

First of all it is apparent that most of them apply to any profession and that they are not limited to engineering. Again, it might appear that one should succeed in a profession if he possesses the first factors in the list, even though he may not possess those included in the last two items. It would be a dangerous conclusion for a young man to feel that his success is assured if he has character and the other qualities which come near the head of the list, and that it is not necessary for him to have thorough knowledge of the technique of his profession. Such an unfortunate would soon find that the ethical qualities alone will not earn his bread and butter, and that a lack of knowledge in his profession will be an immense handicap.

Eckley B. Coxe was a firm believer that there is a "something" required in the making of an engineer which cannot be gaged by an ordinary examination, and I remember well that he told me he employed some highly paid men who did not know an integral sign from a dollar mark, and that he knew of others classed as the best of graduates he would pay high salaries to keep out of, rather than in, his organization. What is the "something"? What is it that the old-time superintendent has in mind as he shakes his head sadly when asked how some young graduate is progressing. The lad may have character, judgment, and perhaps everything in the Carnegie list, or at least he may think he has, and yet our old-time friend, often from the land of the heather, knows there is something lacking. And we ask again, what is this "something"?

Would that I could define the "something." It includes such qualities as taking a personal interest in one's work, amenability to discipline, perseverance under adverse circumstances, cheerfulness and amity—the human side. None of these appears separately in the Carnegie list.

MERE MEMORIZING NOT HELPFUL

We hear and read much respecting teaching methods. Methods are not all; the spirit which unconsciously develops is a most vital factor. I cannot fail to observe that there has been a great change in one respect since I was a boy. In my school days a failure to acquire a subject was laid to the student; now there is a tendency to lay it to the teacher. Much of this is due to the attitude of the parents. A fond mother once told me she thought it strange that no teacher could be found capable of teaching her boy mathematics, not realizing that she herself might be the greatest stumbling block through transmitting the idea that the fault lay anywhere else than with her son. A way never has and never will be found to acquire knowledge without study, and much of the trouble experienced by some students arises through a lack of study or a failure to appreciate the fact that the fault is their own.

Where the teacher is often at fault is in his failure to train the lad to study in a proper way. To memorize is the lowest form of study, and much of our present system may be justly criticized in this respect. A certain amount of memorizing is essential to "train the mind," as our old-time preceptors used to say, but there is much in the doctrine expressed by that lovable professor, John E. Sweet, in the words, "What is the use of teaching a man a mass of material he is bound to forget?"

Recitations and examinations should be conducted so as to bring out more than can be memorized and to take into account the widely varying factors of temperament. It is far easier to lead and have the students follow than to call for initiative and guide them back if they depart from the right path, but the easiest way results mainly in training the memory, whereas the other includes the developing of qualities that are most apt to lead to success.

FUNDAMENTALS MUST BE LEARNED

Let us now consider the broad aspect of education. In the replies respecting the Carnegie qualifications, knowledge of the fundamentals of engineering science and technique of practice and of business were placed at the end of the list. If the judgment of those who responded is correct, are we not therefore taking too much valuable time for such training, and would it not be just as well to shorten the college course? It is an open question whether much could not be eliminated from the college course to advantage, provided special attention is given to teaching the fundamentals. Once thoroughly mastered, the student will always carry with him the fundamentals of physics and mechanics, whereas much that relates to special applications will soon be forgotten. Again, the college should graduate its men young enough to preserve the adaptability of mind which the younger man possesses to a far greater degree than an older. If the assumption is made that the fundamentals are thoroughly mastered and the student graduated a year in advance of what he would be should he study along a number of specialized lines, most of those who employ graduates would favor the younger man with a keen knowledge of the fundamentals to the older man with what might be a lesser knowledge of the fundamentals and more knowledge of specialized lines. The question of whether the school course should be shortened depends on how it is shortened. Shortening the time spent in college may not shorten the course of study as a whole.

AGE OF GRADUATION NOT CHANGING

As far as can be determined from statistics, the average age of graduation from college has not changed appreciably during the past century, being somewhat over twenty-two and a half years. It would therefore seem that, irrespective of what is taught, there are elements entering a college course which have led to men graduating at about this age. I believe it advisable to have a four-year college course, but I would make the entrance requirements and the course such that the students would be graduated at as early an age as has been and is the current practice.

I have taken the stand and firmly believe that our present entrance requirements do not accurately gage the ability of an applicant, and that it is a mistake to make the entrance requirements too high for an engineering college. High technical requirements may result in the preparatory schools specializing along narrow lines in an endeavor to have the student enter college at an early age, to the sacrifice of a broader education. In addition to the examinations, each and every applicant should be met by a board, and all of the circumstances connected with his case considered. Further, the examinations should be given in a way that will bring out the reasoning powers of the students, which can be accomplished if each man is given an oral examination of some length. Here again we have the harder against the easier way, but I am firmly of the opinion that there is no easy way of doing good teaching.

TOO MANY SUBJECTS

The aim in teaching should be to produce a man who will be the most useful to his fellow-men and to his country. Just as we give, so we receive. The fruit of usefulness is achievement, and the building up of achievement, success. We should above all consider the human side and aim to produce a broad man with spirit and determination. It is my firm belief that in many cases we could produce graduates who would more nearly meet our ideals by cutting out much from the present courses of study and by teaching more thoroughly matter already in the courses. The course should be broad enough to include some of the so-called cultural studies, and it further should deal with the business side of the profession. Dr. Alexander C. Humphreys was the first to introduce a regular course of economics in an engineering college, the course including accounting, depreciation, shop cost, law of contracts, specifications, appraisals and business methods in general. As an illustration of matter already in the course that it would be well to teach more thoroughly, I can refer to the writing of concise and logical reports in good English. To this might be added speaking on one's feet before a meeting.

To really know a thing one must have more than an abstract knowledge. Much can be gained by having the students make or witness experiments which verify or illustrate the principles. What a student does with his hands in connection with his head he remembers far better than knowledge which he has obtained from text-books or lectures. Laboratory exercises form a useful basis for practice in writing reports. The best results are secured by returning all reports with carefully marked criticisms, and requiring the student to rewrite those that do not come up to the standard.

Having outlined the general principles of engineering education, the question may be asked, how should we proceed to obtain the best results? I believe that much good would be accomplished if those who employ graduates would co-operate in laying out the courses of study. The visiting boards of some colleges are a step in the right direction, but we need something closer and more concrete than is secured through most such boards. The engineering societies could do most fitting and useful work if they would go seriously into the problem. What is needed is a careful consensus of the judgment of many.

SUGGESTIONS SUMMARIZED

Summarizing, I would make the following suggestions:

1. That there be a closer co-operation between the engineering colleges and those employing graduates and that the engineering societies be encouraged to work along this line.
2. That the technical requirements for entrance to colleges be lowered rather than raised, that preparatory schools be encouraged to give more attention to teaching good English and to giving a broad general education, and that applicants be also judged as to their initiative and general make-up in deciding whether they should be admitted.
3. That the courses be so arranged as to train the initiative and develop the human side; that the students be taught to work in a cheerful and efficient way; that there be proper time for daily relaxation of the mind and that the students be encouraged to use this time to the best advantage.
4. That the professors get down to hard work with their students and know each of them well enough to be thoroughly acquainted with his personal characteristics.
5. That the professors in practical engineering subjects have practical experience so that they can speak with authority.
6. That professors in charge of practical engineering departments be encouraged to undertake practical engineering work, and that their work be so arranged that they can be relieved from meeting classes when the engineering work makes this necessary.
7. That special attention be given to teaching the fundamentals of engineering science, even though this may result in the elimination of certain specialized branches.
8. That greater practice be given in the writing of concise and logical reports in good English, and in speaking on one's feet.
9. That the student be encouraged to confer with the professors, and that regular hours be provided for this purpose, all to the end that the teachers may extend a helping hand where needed and that there be a mutual understanding and trust.

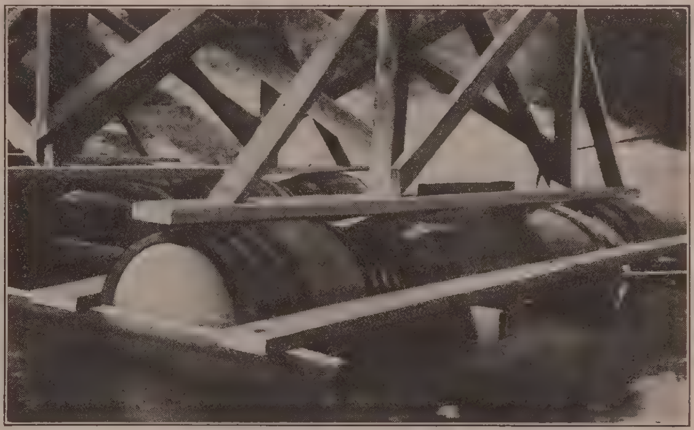
Barrel Pontoon Footbridge Built at Cost of $75

Temporary Crossing of Navigable Stream Required During Construction of New Viaduct —Rope Lines Allow Swingbridge Movement

A UNIQUE and low-cost temporary footbridge to accommodate pedestrians after an old viaduct was removed and during the construction of a new concrete viaduct over the Trinity River at Dallas, Tex., was made in one day by four carpenters, using light timber bents supported by barrel pontoons. The total cost for the bridge, which is more than 50 ft. long with 20-ft. gangplank approaches at each end, was only $75. As the law requires that this river be kept navigable, the bridge is moored at each end by a 1-in. rope. In order to allow a boat to pass, one end of the rope is cast free and the bridge turns downstream.

The general scheme of construction is clear from the accompanying photographs, there being ten rows of barrels, four barrels in each row. The footbridge is 4 ft. wide and 7 ft. above the water, and is constructed of 2-in. plank. A rigid frame retains the barrels in position. The rows are spaced about 6 ft. apart, each row supporting a timber bent, with X-bracing and struts as shown. Longitudinal X-bracing is provided in addition to the timber spacers in the water between the barrels.

FOOTBRIDGE CARRIED BY BARREL PONTOON


FOUR BARRELS PER ROW HELD BY PLANK FRAME

When it is necessary to move the bridge to allow an infrequent rowboat to pass, it is easily cast loose at either end, as already mentioned, and the stream carries it to open position in about 10 minutes. Two men can pull it back into place in about 20 minutes. Driftwood and other floating obstructions are disposed of in the same way.

The new viaduct is being constructed by the Gilsonite Construction Company. Part of it is under the direction of the county, and it was at the suggestion of Assistant County Engineer Wickline that this type of bridge was built.

Time to Go Through Panama Canal

The average time for a vessel to go through the Panama Canal is 11 hours 40 minutes, according to the *Panama Canal Record*. The minimum time recorded is 7 hours 17 minutes, and the maximum is 1 day, 8 hours and 10 minutes. The figures, obtained by observing 158 vessels passing through the canal, show that more than half of the ships were in the passage between 9 and 12 hours. Those requiring more than 12 hours numbered 48.

Highway Engineers Discuss Various Phases of the Motor-Truck Legislation Problem

Symposium in Which Are Expressed Opinions on the Preservation of Highways by Controlling the Vehicles Which Use Them

IN an editorial published in the issue of Oct. 28, page 519, the Engineering Record discussed certain phases of the question of motor truck legislation as a protective measure for highways and outlined the rules and regulations proposed for the State of New Jersey. Comment on this general subject was invited. Among the replies received are the following:

By NELSON P. LEWIS

Chief Engineer, Board of Estimate and Apportionment, New York City

Referring to the proposed code of regulations for motor trucks in New Jersey, as outlined in the issue of the Engineering Record of Oct. 28, and your editorial comment setting forth objections raised by the Motor Truck Club of America, permit me to offer the following comments:

The regulations proposed by the New Jersey authorities appear to me to be in the right direction. In some instances they may have gone too far, and it is unlikely that they will be finally adopted without further study and after hearing both sides. An absolute restriction as to width of vehicles appears to be necessary in order that there shall be no serious reduction in the traffic capacity of public highways, which would inevitably result from the use of vehicles of excessive width.

I am not sure of the wisdom of an absolute limit of 23 ft. 6 in. in the length of motor trucks or of the prohibition of more than one trailer, except possibly within the congested districts of large towns. Trailers can be and some are now so constructed that they will closely follow the tractor and will not cut the corners.

The prohibition of steel tires on trailers appears to be of doubtful wisdom, provided the wheel loads and speeds where steel tires are used are kept within reasonable limits.

The plan of grading the annual fee in proportion to the gross weight and carrying capacity is rational and it might well go farther and make the total width of the vehicle, where such width exceeds 7 ft., an element in the determination of this fee.

A step in advance in American practice appears to be the introduction of the wheel diameter and the speed in determining the weight to be permitted on each of the rear wheels.

Full discussion of these rules is very desirable, and it must be borne in mind that vehicles must be adapted to the roads as well as the roads to the vehicles.

Speaking before a meeting of the American Road Builders' Association in New York City recently, Mr. Lewis said, in substance:

There is a very serious problem which has grown out of the use of motor vehicles, namely, the increasing weight, the increasing wheel loads and the increasing size of these vehicles. The motor or the tractor can overcome grades with heavy loads which were impossible for the horse-drawn vehicle, and highway officials responsible for the maintenance of our city streets and of the country highways leading out of them are greatly concerned at the damage inflicted upon road surfaces by these loads. The only effective remedy appears to be the enactment of laws which will absolutely prohibit the use of vehicles having more than a specified load per inch width of tire, and that load should probably be less for steel tires than for rubber tires.

The width and length of such vehicles is a matter of serious concern, especially on city streets. Where roadways have been designed to accommodate a certain number of lines of traffic and the number of lines is reduced through an increase in the width of the vehicles, the capacity of the roadway is reduced in still greater proportion, and, if this increase in width is allowed to proceed, very costly street widening will become necessary. In this case also it would appear to be necessary to prohibit absolutely the use on our highways of vehicles having more than a certain specified width. The state legislature of Pennsylvania in 1913 passed a law prohibiting the registration of motor vehicles exceeding 90 in. in width of load and vehicle combined, except that motorbuses having a total width of 100 in. for carrying passengers may be used within the limits of cities of the first, second and third classes. This law also prohibits loads in excess of 24,000 lb. for vehicle and load combined and in excess of 18,000 lb. gross load on any axle, or 750 lb. per inch width of solid tire.

Fortunately the tendency of the manufacturers of motor trucks appears to be in the direction of more moderate loads. Of 221 manufacturers producing commercial vehicles at the beginning of the present year 133 confined themselves to those of less than 3 tons capacity. Of the 88 manufacturers offering trucks of more than 3 tons capacity twelve appear to have increased this capacity in their models for this year. Only three decreased the capacity of their trucks, one from 4 to 3½ tons, one from 6 to 4 tons, and one from 7½ to 5 tons. Of twelve newcomers in the field only one offers a truck with a capacity of 6 tons and two of 5 tons, while the rest provide for smaller loads.

The imposition of an absolute limit upon wheel loads and upon the dimensions of vehicles seems necessary to preserve our highways, both in the city and country.

By FRANK F. ROGERS

Commissioner, Michigan State Highway Department

We have your letter calling our attention to the article and editorial in the Engineering Record relative to the tentative rules for the regulation of motor truck traffic in New Jersey. We have read the articles referred to and are fully in accord with any movement to prevent the rapid destruction of roads and pavements by the regulation of such traffic. We thank you for the opportunity of commenting on the situation.

It would seem to us that the use of steel tires on trailers would not be relatively more destructive to the pavement than similar tires on horse-drawn vehicles. The matter of wheel loadings is one which is vital to the situation. In view of the increased traffic and the expectation of further increases in the future, we believe that the wheel loadings expressed in the tentative rules are not excessive.

Worthy of especial emphasis is the fact that no lugs or staggered block tires should be permitted, as these very greatly increase the impact delivered to the pavement. We would consider it advisable to allow more than one trailer to a truck. In fact, it would be better to encourage this than to permit single trucks to carry loads of 8 or 10 tons.

The matter of speed regulation seems to have caused considerable discussion. One thing is certain; there must be regulation of the speed of motor trucks, especially when heavily loaded. Just how to effect this regulation is a matter which must be worked out.

By A. R. HIRST

State Highway Engineer, Wisconsin Highway Commission

We have received your letter of Nov. 1 and have carefully read the two items in your issue of Oct. 28. Your editorial has discussed the proposed regulations so thoroughly that we can add nothing thereto.

The matter of regulating motor trucks has not yet become a problem with us. The only point in this state where there is an appreciable amount of truck hauling outside the limits of cities is in Milwaukee County, which has a very large mileage of concrete highways, which have so far suffered absolutely no damage.

It appears to us, however, absolutely necessary to fix some limits to the wheel loads of motor trucks; otherwise their development will be such as to keep just a little in advance of the paving development. In other words, it will be another phase of the continuing struggle between the armormaker and the projectile manufacturer. It seems to us that, in fixing this limit, it is more logical to use as an index the possibilities of paving than existing practice in the manufacture of automobiles.

While there is and always will be progress in paving, the possibilities of the most practical types are pretty well understood, and it seems to us that it is much easier to adapt the automobile to the paving than the paving to the automobile. So long as these regulations are reasonable and impartially enforced, it would seem to give all manufacturers an equal opportunity and to avoid working a hardship on any except possibly for a short time on those who are manufacturing extreme types.

By EDWARD N. HINES

Chairman, Wayne County Road Commission, Michigan

I believe that the purposed action of the State of New Jersey toward the use of motor trucks on public highways is timely and necessary, and I would include in any restrictive law of this character traction engines, road engines, steam rollers, or other power vehicles the faces of whose wheels are fitted with spikes, flanges, ribs, clamps, cleats, rings, or lugs.

The tendency of traffic generally is toward greater speeds, wider gage, and heavier loads, and it seems to me that there is a limit beyond which the community should not be compelled to go in building a road that will stand up under every conceivable type of traffic. I believe that the loading and speed should be regulated, and with reference to speed the regulation should cover running light as well as loaded, more especially when trailers are used.

I have seen motor trucks with iron-tired trailers going along at 20 to 25 miles an hour, with trailers swaying from side to side, bounding in the air, and acting as trip hammers on the metaled road. Such practice is destructive both to the trailer and to the road. Trailers of every description should be fitted with rubber tires. It would be desirable to have uniform regulations throughout the country, and a model law might properly be drafted with this idea in view.

By PROF. A. H. BLANCHARD

Consulting Highway Engineer, New York City

If public highways are to be economically constructed and efficiently maintained, it is absolutely necessary that adequate legislation should be passed by state legislatures covering the utilization of highways by horse-drawn vehicles, touring cars, motor trucks, trailers, motorbuses and traction engines. These regulations should cover the operation of all types of vehicular traffic, permissible loads per linear inch of width of tire, and width, length and height of vehicles. Such regulations should be enforceable by state authority and not be left, as is the case at present in New York State, to the control of town and county officials.

Few people realize the traffic to which our trunk highways will soon be subjected. As an illustration might be cited information furnished by the Public Service Commission of the State of New York to the effect that over one hundred motorbus routes are today in operation within the state. In some cases the motorbuses carry as many as forty passengers, have a horsepower rating of 75, weigh, loaded, as much as 8 tons, and have an overall width of 90 in. It is well known to the traveling public that when meeting motor trucks and motorbuses having widths of nearly 8 ft. it is necessary, in order to avoid a collision on a 16-ft. roadway, to turn out on soft shoulders. Accidents resulting therefrom are daily occurrences. [Extract from address before the Poughkeepsie (N. Y.) Automobile Club, Dec. 4, 1916.]

By W. R. D. HALL

Statistician, Pennsylvania State Highway Department

Pennsylvania is contemplating changes in her motor-vehicle law, particularly with reference to legislation along sane and reasonable lines in the commercial-truck subject. At this time, however, we are not in a position to give you any comment on this subject, as we are making a digest of laws and regulations from other states dealing with it and wish to select that combination which seems best applicable to conditions in our own state.

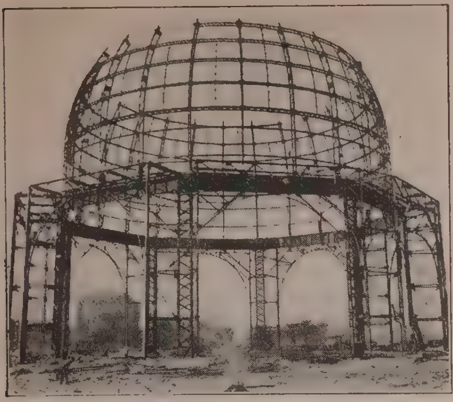
When we have done this I will be pleased to send you a copy of our conclusions, which we hope to have embraced in an act to be submitted to the next legislature.

Safety Belts Were Used in Wrecking Steel Dome

Palace of Horticulture, 175 Feet High, at Panama-Pacific Exposition, Cut Down by Torches with Slight Loss of Steel

THE Palace of Horticulture, which visitors to the Panama-Pacific International Exposition in San Francisco will remember by the weird-colored lights which moved within its huge glass dome at night, was sold as it stood for $5,000. The General Welding & Cutting Works, which purchased the structure, stripped off the glass and woodwork, and when nothing remained but the steel skeleton used oxyacetylene torches to cut it down. Dismembered sections were allowed to fall freely as they were cut away.

SAFETY BELT FACILITATED WORK



STEEL SKELETON, PALACE OF HORTICULTURE

The dome proper was 150 ft. in diameter and 100 ft. high above the supporting arches, or 175 ft. from floor level to top of dome. When the structure was stripped down to the steel skeleton, four men equipped with life-belts and oxyacetylene torches were put to work, starting at the top of the dome. In ten days they had entirely dismembered the dome proper. The removal of the entire steel frame, which was accomplished by a crew of only eight men, was completed in about three weeks. The steel totaled about 600 tons in weight, of which 350 tons was included in the skeleton of the dome proper.

PLAN FOR WRECKING

The plan first proposed for the wrecking involved the cutting off of vertical members so that the circumferential bands would fall in a single piece. The Department of Safety of the California Accident Commission, however, suggested that it would be better to cut out sections of the circumferential bands between uprights, taking one section at a time. They insisted further that the workmen should be provided with the safety belts. It was pointed out that the dismantling of the structure in this way would not only be a safer procedure but would probably involve the loss of less material due to breakage.

ONLY 2 PER CENT OF STEEL DAMAGED

This proved to be the case, as the short sections which were allowed to fall were comparatively light, and it is estimated that not more than 2 per cent of the steel was damaged in falling. This was in large measure owing to the fact that the area into which the pieces fell from the dome was a soft earthfill, and the fallen pieces were removed promptly so that sections falling later would not strike them. Of course, the members of the supporting frame which could be handled by tackle after being cut free were taken down that way. As a result of the precautions to safeguard workmen not a single accident was reported on the work, although it was considered an unusually high risk.

Because of the high prices of steel and greatly delayed deliveries on the Pacific Coast, the structural shapes salvaged from the Palace of Horticulture are finding a ready market, it is stated. Some of the larger shapes are bringing as high as $40 per ton.

John R. Brownell is superintendent of the Department of Safety of the California Accident Commission and J. J. Rosenthal is safety engineer.

Difficult Construction for Intricate Design of Ripon Siphonic Spillway, California

Concrete Costs $25 a Yard in Place—Loose Sand Increases Excavation Cost—Curved Forms and Sharp Angles Expensive

IN THE CONSTRUCTION of the Ripon siphonic spillway, near Ripon, Cal., difficult formwork and correspondingly slow and expensive construction resulted from the use of curves of small radii, angular sections and projections, small concrete sections and heavy reinforcement bent to curves. Mill work was resorted to in most of the curved siphon sections, and only one carpenter and his helper could work at a time. Progress on the steel and concrete work was consequently slow. After each pouring the concrete had to be allowed to set before work on those forms could be resumed. To accelerate construction, work was begun at each end of the structure, which kept the small gang employed constantly. Had it been possible to carry on excavation continuously the construction cost would have been materially less.

LOCATION

The Ripon spillway is located at the end of the main distributary canal of the South San Joaquin Irrigation District, approximately 3 miles northeast of Ripon. It was designed automatically to discharge all water in excess of the capacity of the main canal and any desired amount through a radial steel gate operated by a geared hand control and concrete counterweight.

This steel gate has a wooden watertight face bearing and a discharge opening approximately 11x6 ft. On each side of the gate is an automatic siphon 2x3 ft. neat dimensions, individually primed. One is at the high-water elevation of the main canal; the other is at a water stage 0.07 ft. higher, discharging through a curved outflow into the main section of the spillway. The discharge from the steel gate and the two automatic siphons is carried in a transition ditch section, laid on a 5-per cent grade 110 ft. long, into a lake which drains to the river.

The upstream 70-ft. section crosses a county road spanned by a reinforced-concrete slab bridge, built with the strengthened side walls of the transition section to serve as abutments.

ROAD KEPT OPEN TO TRAFFIC

The road had to be kept open to traffic at all times, which necessitated the diversion of traffic about 30 ft. to the south and prohibited the excavation of that section crossed by the temporary travel. Also, in excavating the headworks, the dirt had to be dragged lengthwise with the structure up a steep grade and there loaded. A material saving would have been effected could access have been had at this point as well as each end when work was begun.

The excavation of the entire structure was in loosely compacted sand, which sloughed away on exposure. This caused sand slides to fill an already completed excavation, which, of course, delayed the work. In other cases, loose sand retarded the pouring of concrete. With the exception of the downstream floorbeam in the flume section, no ground water was encountered in building the superstructure. In sinking the pile foundation for the flume section, ground water was found at a depth of only 2 ft. below the pile heads.

FORM WORK SLOW

The form work was quite tedious, as it was necessary in a number of cases to build a small portion of the structure and let it set. The center wall of the siphon was built first. The 14-in. terra-cotta pipe was embedded at the same time, and the partition wall between the priming siphon and the main siphon was built to an elevation of about 3 ft. above the pipe. The remainder of this partition wall between the two siphons was built on its edge outside the works and allowed to set. It was then placed in position with block and tackle and concreted in. The wall against which it was placed was rabbeted and trimmed neatly to scale so that it went exactly into position and had ample concrete on all sides to make it airtight.

The slightly inclined portion of the siphon on the lower end has quite a complicated form, as it is curved in two directions. The forms were warped in by eye, but in such a manner that each normal cross-section is a 2 x 3-ft. rectangle.

CONCRETE-PILE FOUNDATION

The downstream 40-ft. section is supported on reinforced-concrete piling. It is 4 x 8 ft. in inside dimensions and is carried on an 8-in. floor. The piles are arranged in three bents of four piles each, capped with a 12 x 12-in. reinforced-concrete beam 9 ft. 6 in. long. The bents, spaced 12 ft. on centers, consist of 12-in. piles spaced 34 in. on centers, cast in place. A contract was let for the pile forms in place with the core removed. These forms were sunk with an ordinary well-drilling outfit, the core being removed with a sand pump slightly in advance of the casing.

Upon removal of the sand pump with the casing at the required depth, the casing was immediately sealed. This was accomplished by tamping a jute sack half full of slightly

COST REPORT ON RIPON SPILLWAY

Item	Material	Labor
*Excavation	.....	$235.46
Forms	$169.85	269.85
*Steel	317.16	98.73
*Concrete	782.61	282.25
Form metal	21.89	.....
Nails	12.63	.....
Tools	18.75	.....
Milling forms	.....	16.79
Stripping forms	.....	27.79
Cleaning lumber	.....	18.18
Backfilling	.....	92.06
Camp labor	.....	15.86
Miscellaneous labor	.....	24.90
Hauling water wagon	.....	17.38
Gate labor	.....	55.43
Gate materials:		
Steel face	400.00	.....
Wooden runners	14.04	.....
Bolts	2.90	.....
Lifting apparatus	150.00	.....
Flashboards	4.00	.....
I-beams	4.32	.....
Gate axis	13.55	.....
Hauling gate	1.92	.....
Air intakes	10.36	.....
Placing siphon lips	.....	7.68
Placing priming outflows	.....	10.31
Priming outflows	18.40	.....
Well boring	.....	343.75
Cook-house debit	187.63	.....
Rental equipment	50.00	.....
Superintendence-engineering	.....	350.00
Total	$2,180.01	$1,866.42
Grand total		$4,046.43

*950 cu. yd. excavation; 7.06 tons steel; 161.4 cu. yd. concrete.

moistened 1:2:4 concrete to the bottom of the casing. During the interval between the withdrawal of the sand pump and the final tamping into place of the concrete, ground water sometimes forced the sand up into the casing. This caused a part of the depth to which the casing was sunk to be lost to concrete, as is seen in the records of the pile costs. After sealing, the wells were allowed to stand five days, when they were bailed out, the reinforcement placed, and concrete poured. The reinforcement in each pile consisted of heavy mesh, cut to length and bent circular to fit the pile, and five ½ x 5-in. twisted bars to bond the pile and cap.

The 10 ft. of soil through which the casings were driven was coarse sand. Underneath was a stratum of well-compacted fine river-bottom silt, varying in depth from 12 to 24 in., under which was a coarse sand containing some gravel. Ground water was encountered at a depth of about 2 ft.

Materials were either bought in Ripon or unloaded from cars at that point. Cement was purchased f.o.b. Ripon. The hauling was contracted for at $10 for a car of 640 sacks.

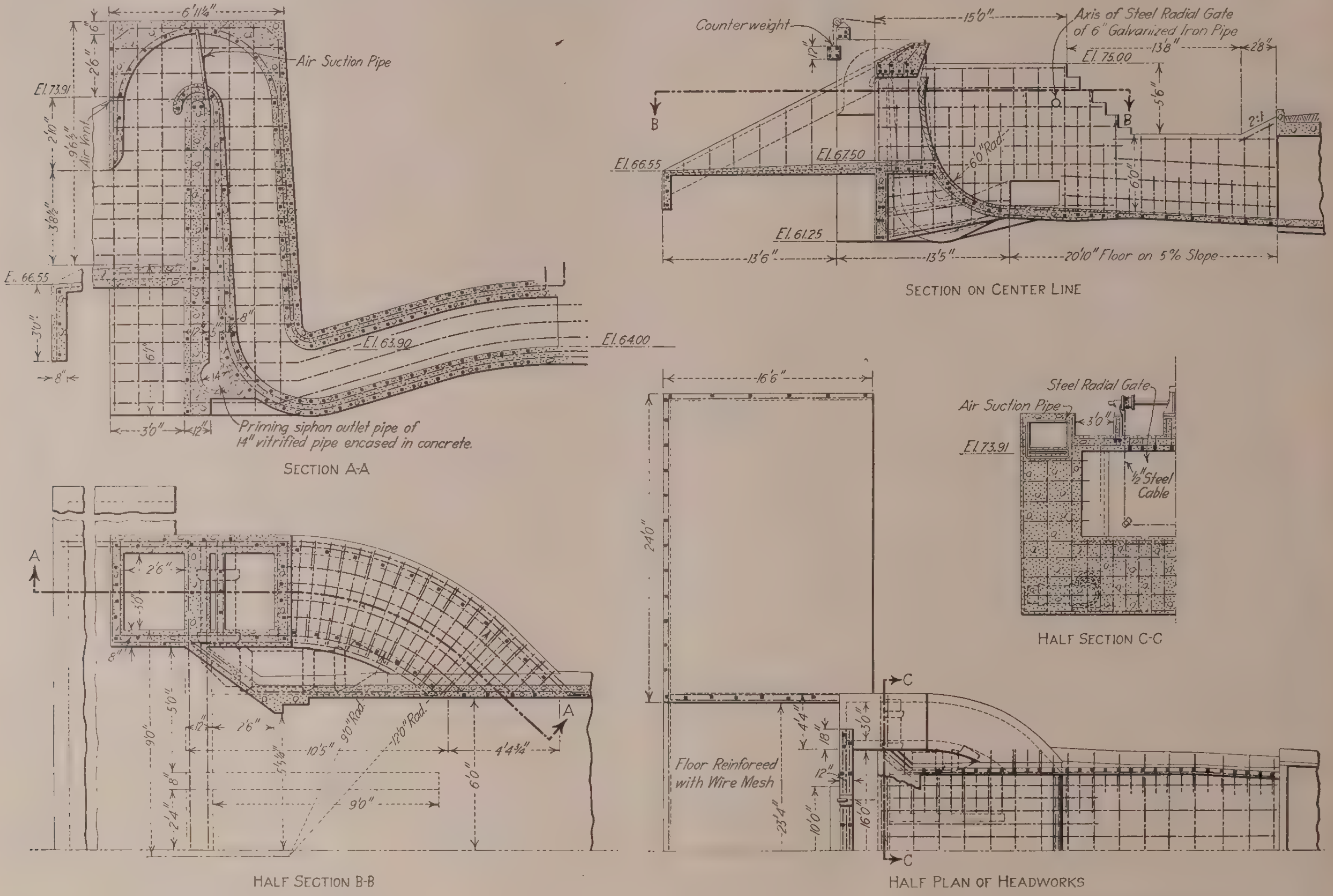
Lumber was purchased in Ripon and hauling was at the rate of $5 per day. Unloading and hauling rock were contracted for at the rate of 60 cents per ton for 105.77 tons and 100 tons at 70 cents per ton.

The high cost per meal (43.2 cents) was due to the small crew boarding regularly at the cook shack. However, this expense was justifiable considering that if there had been no cook shack on the job it would have been necessary to board the men at the hotel and to hire a line wagon at an additional expense. The cook-house debit of $187.63 was therefore an economic waste.

The cost per yard of concrete in place was about $25. The total cost per sack for cement was 60 cents. Rock cost $1.97 per cubic yard and sand 30 cents. A Smith hand mixer of 2½-cu. ft. capacity was used. The pile foundation cost $1.59 per linear foot, this figure including labor and extra work.

The time record for sinking piles showed that on one bent of four piles it required an average of 14 man-days to sink one casing to an average depth of 16 ft., with 10 ft. average depth of concrete. To sink a casing 20 ft., with an 11 ft. 6 in. depth of concrete, took, on an average, 29 days. In sinking casings 30 ft., with a depth of concrete of 22 ft., the time averaged 42 days. In the latter instance a casing froze on large gravel and had to be withdrawn. That took 24 man-days extra.

The work was done by the South San Joaquin Irrigation District, of which A. Griffin is chief engineer.



SECTIONS THROUGH RIPON SIPHON GIVE IDEA OF DIFFICULT CONSTRUCTION IN BUILDING FORMS AND PLACING REINFORCING

Use Pictures in Organization Chart

To familiarize those who come in contact with the Illinois Highway Commission with the personnel and scope of the organization, a new 12 x 17-in. chart has been issued and sent out with the November issue of *Illinois Highway*. The distinctive feature is the use of small photographs, ¾ and 1 in. in diameter, of the engineers holding the twenty more prominent positions. The organization was described in the Engineering Record of March 18, page 393.

Advice to Young Engineers

Sir Maurice Fitzmaurice Says Choose the Small Place on a Large Job Rather Than the Large Place on a Small Job

SIR MAURICE FITZMAURICE, in his presidential address before the Institution of Civil Engineers on Nov. 7, repeated advice he has frequently given to young engineers as to the proper choice between two types of employment. As between work on a large job with small salary and on a small job with larger remuneration, he would advise the former. He succinctly states the problem and his advice as follows:

"I have on one or two occasions been asked by a young engineer whether, of two posts offered to him he should take that of one among many assistants on a large work with a small salary or that of resident engineer on a small, unimportant work at a considerably higher salary. Without hesitation I recommended the former position. I knew that on the large works he would see a little of almost every class of work, that even the temporary works of the one were probably more important than the permanent work of the other, and that the fact of being on a large work would be of great assistance later on, and would stand to him all his life. He would also have the advantage of daily intercourse with other engineers, and the emulation and friendly rivalry between them would lead to efforts on his part to hold his own. There also exists on large works a feeling, which I can only describe as engineering atmosphere, which may have a real influence on the life of a young engineer."

Reinforced-Gypsum Roof Decks a Modern Development in the Structural Field

Theoretical Formulas Are Proposed for the New Combination of Materials and Allowable Working Stresses Are Based Upon Tests

By VIRGIL G. MARANI
Consulting Engineer, Cleveland, Ohio

SCIENTIFIC THOUGHT directed to economical construction and the conservation of owners' interests has developed the necessity of engineering as well as architectural skill in the use of materials and the layout and design of the modern utility building. In applying the principles of engineering efficiency to the design and construction of modern buildings, every material used, from the foundation to the finished roof deck, should be selected with due consideration of the function it is expected to perform, its durability, practicability and economy.

The ideal material to be used for roof-deck construction must, in addition to its usefulness as a weather protection, possess the following properties:

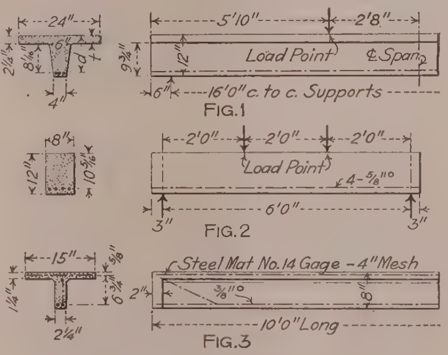
1. *Fire Resistivity and Incombustibility*—In case of fire and the consequent change of temperature, the roof deck must not flame or support combustion, nor expand, warp, buckle or spall.
2. *Low Heat Conductivity* — Materials with low heat conductivity are not so likely to condense moist air within the building upon their exposed under surface. This requirement also insures a warmer roof surface in the winter, and consequently a proportional saving in the design of the heating system. In the summer cooler interiors are made possible.
3. *Light Weight and Strength*—Consistent with the strength required as determined by test and standard engineering practice, light weight is important. A reduction of a few pounds of dead load per square foot of roof deck results in considerable saving in the necessary roof trusses and support, structural frame, walls, foundations and footings. Light weight is also an economic factor in the cost of erection (hoisting and placing), and also in the freight and teaming charges to the job, all of which are cost items to the owner.

USE OF GYPSUM TILE

Ordinary gypsum roof tile, reinforced with steel, 3 in. thick and 30 in. long, weighing 13 lb. per square foot, have been used for 10 years or more for the roof decks of cotton and textile mills, foundries, laundries and similar buildings where much inconvenience and trouble is often experienced from the condensation of the moist air upon the under side of the cool roof-deck surface. The success of gypsum for roof decks in buildings where moist air was in excess dated from its inception, and suggested exhaustive and elaborate chemical and physical tests to determine to what extent specially prepared gypsum could be reinforced (as in the case of concrete) and whether a construction of this material could be economically marketed, either as a factory-built unit in spans up to 16 ft. or more or to be poured in molds and erected at the job.

As a result, there has been developed a new structural gypsum termed "Structolite." This is a quick-setting gypsum cement (setting in 15 minutes) capable of being removed from the molds in 4 hours after being poured. It attains full working strength in 24 hours, weighs 77 lb. per cubic foot (about one-half as much as concrete), and its ultimate compressive strength averages 2000 lb. per square inch.

There has also been developed and placed upon the market a reinforced-gypsum roof-deck tile made of this structural gypsum which is believed to possess in a high degree the ideal requirements for roof-deck construction. Tests have been conducted for the manufacturers, the United States Gypsum Company, by Willis A. Slater, research assistant professor of applied mechanics, at the laboratory of the University of Illinois, and constants for use in theoretical design formulas obtained.



DETAILS OF THE VARIOUS BEAMS TESTED

Standard 4-ft. and 5-ft. tile (Pyrobar), with reinforcement curved at the ends, are made in factory-built units, and this "Structolite" has recently been applied to a roof span of 10 ft. by casting the reinforced units at the building site. Results of tests and a description of the design of the latter units are here given.

DESIGN FORMULAS

The stresses in reinforced-gypsum beams may be computed by the usual formulas for reinforced concrete, such as those of the Joint Committee. For T-beam analysis a simplification which appears to be justified by the results of tests can be made by neglecting the compressive stress in the web below the flange and assuming the center of compression to be at the center of the flange. In other words, using standard nomenclature, the effective depth id is equal to $d—t/2$. When the computation for kd shows that the neutral axis falls within the upper flange the computations are made as for a rectangular beam in which $p= A/bd$, instead of $p = A/'d$.

10-FOOT TILE LOADED WITH 3500 LB.

The modulus of elasticity for gypsum appears, according to the results of tests, to average about 1,000,000 lb. per square inch. This gives a ratio $n=E_s/E_g= 30$ for use in formulas. Working stresses here proposed are believed to give safety factors of two when the tile is saturated and not more than 24 hours old, and not less than four when the gypsum is dry and steel reinforcement of high elastic limit is used.

PROPOSED WORKING STRESSES FOR REINFORCED GYPSUM

	Pounds per square inch
Compression in gypsum	350
Shear in gypsum	20
Bond between gypsum and steel	30
Bearing of gypsum on looped bars or anchor plates	300
Tension in steel	16,000

The accompanying table gives allowable stresses based upon tests of water-soaked specimens, and should be applied only to roof deck slabs.

RESULTS OF TESTS

The results of the series of tests already mentioned are presented in the accompanying tables. In Table 1 is given the results of two tests of reinforced-gypsum T-beams of 16-ft. span between supports. As indicated in Fig. 1, the reinforcing rods were not turned or looped at the ends, so that no provision was made for anchorage other than the bond between steel and gypsum. The specimens were alike, reinforced by three ⅝-in. corrugated round bars of area 0.92 sq. in. and tested at the age of 20 days by the application of two symmetrical loads.

TABLE 1—TESTS OF 16-FOOT T-BEAMS

		Beam 1	Beam 2
Load of first crack, pounds		5,250	6,300
Observed steel stress at first crack, pounds per square inch		19,000	22,000
Maximum load, pounds		7,850	6,300
Computed stresses at maximum load, pounds per square inch	Vertical shear in gypsum	87	70
	Bond	74	60
	Tension in steel	29,200	24,400
Observed stress at maximum load, pounds per square inch		28,600	23,000
Observed compressive stress in upper face gypsum at maximum load, pounds per square inch		507	454

No indication of approaching failure of the gypsum by compression was found in these beams. Failures occurred as a result of diagonal tension only.

With a good grade of gypsum such as is found in many parts of the country it has been possible to develop regularly from 1500 to 2000 lb. per square inch in compression specimens of height equal to twice their diameter. This is equivalent to, say, from 2000 to 2700 lb. per square inch for the usual cubes. In certain cases a strength of 3200 lb. per square inch has been developed.

A rectangular reinforced-gypsum beam

TABLE 2—TEST OF RECTANGULAR BEAM. CALCULATED STRESSES AT MAXIMUM LOAD OF 23,980 LB.

	Pounds per square inch
Compression in gypsum	1,580
Vertical shear in gypsum	146
Horizontal shear in gypsum	187
Bond	191
Tension in steel	29,200

10-FOOT TILE LOADED WITH 2000 LB.

of 6-ft. span, Fig. 2, was also tested, with results given in Table 2. Four ⅝-in. corrugated round reinforcement was used, a total of 1.22 sq. in., and the test was made at the age of 10 days. Failure occurred by diagonal tension when the first crack appeared.

10-FOOT BEAMS DESIGNED

Using the information gained from these investigations, which included tests for compressive strength, modulus of elasticity, bond strength and tests upon numerous rectangular and T-shaped beams of spans of 6 ft. and 16 ft., the gypsum T-beam roof slab of Fig. 3 was designed for the Walker Manufacturing Company, Racine, Wis. This is the first long-span gypsum roof-deck slab in the United States which was poured and erected at the job. A description of this construction will appear in next week's issue.

Before acceptance of this construction five sample T-beam roof slabs similar in detail to the designed T-beams were made and tested in Chicago by C. Payne, the designer. Some of these specimens were less than 24 hours old at the time of the test and all of them had been exposed during the previous night to the full effect of a heavy rain. Consequently the gypsum was in such condition as to make the tests especially severe.

Each roof beam was placed upon a solid support giving a bearing of 2 in. at each end of the beam, leaving a clear span of 9 ft. 8 in. The distributed load was piled from the center toward the bearings in increments of 150 lb. Table 3 shows the test loads applied.

SAFETY FACTOR OF FOUR

These reinforced roof slabs were designed to carry a uniformly distributed live load of 50 lb. with a safety factor of four.

TABLE 3—TEST OF 10-FOOT T-BEAMS

Sample No.	Load applied	Load per square foot	Deflection, inches	Remarks
1	2,200	200	0.034	At these uniformly distributed loads there was no sign of failure
2	2,400	218	0.070	
3	2,200	200	0.034	
4	2,200	200	0.034	
5	2,400	218	0.070	

After the foregoing tests the total loads were increased to 3500 lb., but other than the manifestation of horizontal shear cracks there was no sign of failure. The illustrations show these gypsum roof slabs loaded to 2000 and 3500 lb.

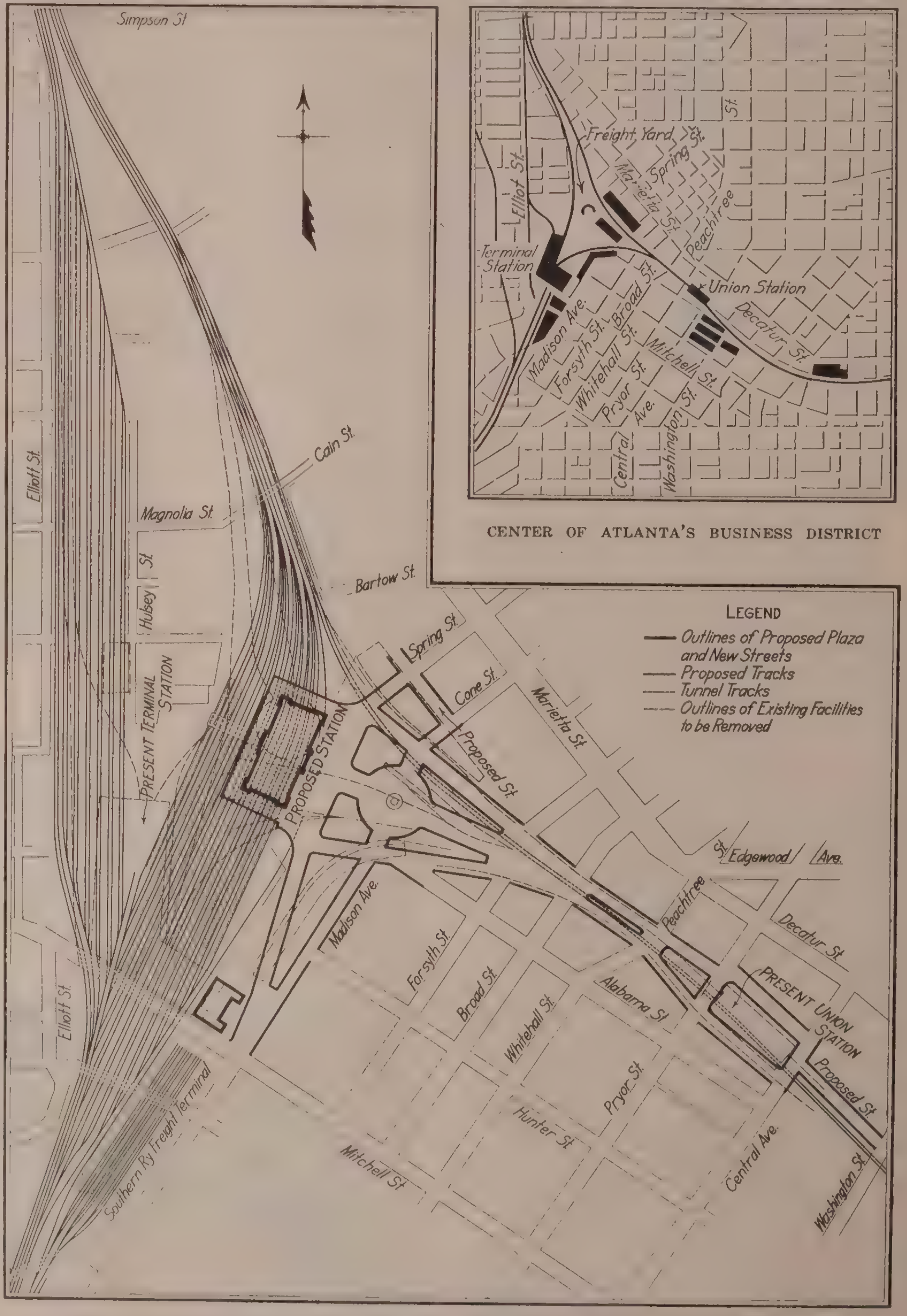
The weight of these long-span reinforced-gypsum roof slabs is 17 lb. per square foot. When the effect of a continuous rather than a beam ceiling is desired, the same slab can be made in an H-section with a bottom flange similar to the top flange. A roof slab of this form weighs about 24 lb. per square foot, and has the same carrying capacity for live load.

[*An article describing the methods used on the roof deck construction of the Walker Manufacturing Company, at Racine, Wis., will appear in the next issue.*—EDITOR.]

Would Replace Atlanta's Two Passenger Terminals with One on New Site

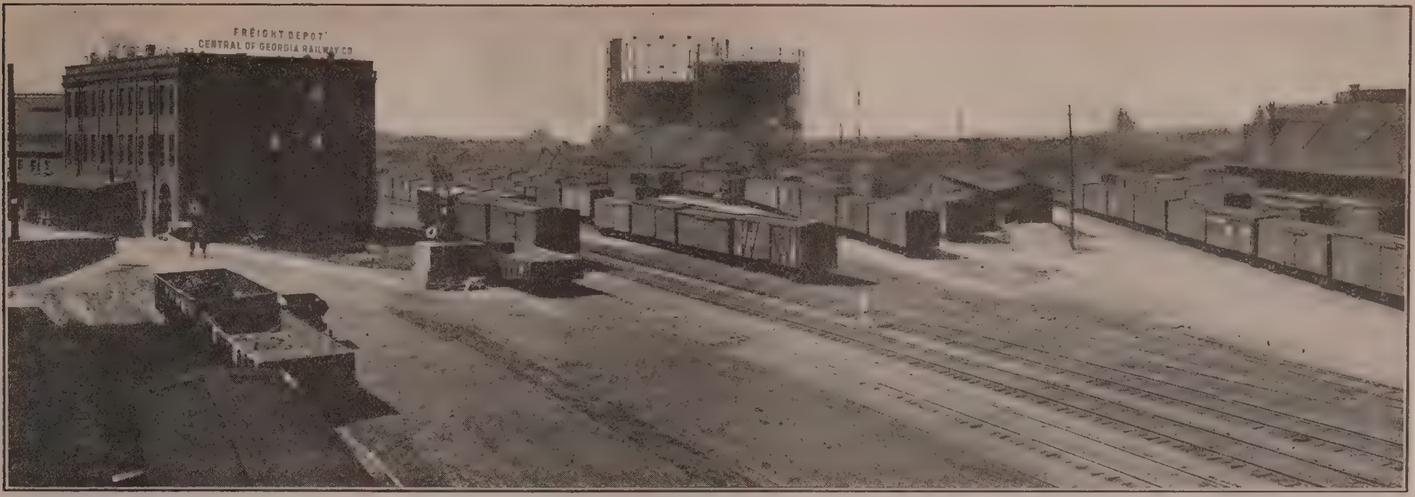
Barclay Parsons & Klapp Would Combine Previous Plaza Schemes with Elimination of Almost All Tracks from Heart of Business District

COMPLETE ABANDONMENT of the two existing passenger terminals and, except for two through tracks, of all railroad facilities between the terminals, which are about half a mile apart, is among the features of the somewhat radical plan proposed by Barclay Parsons & Klapp, consulting engineers, of New York City, as the best solution of the terminal problem at Atlanta, Ga. Prior to the retention of these engineers by the city other plans had been promulgated which, recognizing the undesirability of the railroad barrier between the two stations, in the heart of the business district, proposed to eliminate the remaining grade crossings and cover the entire railroad area between Forsyth and Washington streets, converting this area into a park. By this plan the old Union Station could be remodeled and somewhat enlarged, while the newer Terminal Station would remain unchanged. The New York engineers, in a comprehensive report recently rendered, which is the basis of this article, hold that these plans do not go far enough, in that the existing stations cannot be sufficiently enlarged on their present sites, that the covered area could not be properly ventilated except by electrification of the tracks at a prohibitive cost, and that this scheme would leave the freight yards and roundhouse west of Forsyth Street as



CENTER OF ATLANTA'S BUSINESS DISTRICT

PROPOSED STATION WOULD BE ADEQUATE FOR TRAFFIC OF ALL ROADS AND WOULD FACE DIRECTLY ON PLAZA



THESE RAILROAD YARDS ARE ALMOST IN HEART OF BUSINESS DISTRICT—PROPOSED STATION WOULD BE ON SITE OF ROUNDHOUSE DIMLY SEEN IN MIDDLE BACKGROUND, AND ALL OF FOREGROUND WOULD BECOME PART OF PLAZA

a permanent nuisance barely outside of the best business district. They recommend the building of a new union station for all eight of Atlanta's railroads about 900 ft. northeast of the Terminal Station, on the site of the present freight yards, the replacement of these freight facilities by others to be built along Elliott Street, the retention of two tracks only, in single-track tunnels, from Washington Street to the north end of the new terminal layout, and the filling in of the entire railroad area around these tunnels. They estimate the cost of the improvement, inclusive of the passenger station but exclusive of the trackwork and the auxiliary buildings of the new terminal, at $6,500,000.

ATLANTA'S STREETS AND TERMINALS

For an understanding of the situation the report calls attention to the street map of the city, part of which is here reproduced. The city's street system is very irregular. The principal thoroughfares are Whitehall-Peachtree and Marietta-Decatur, which intersect approximately at right angles. The existing tracks, roughly parallel to Decatur Street, form a railroad barrier through the very heart of the business district. As the Pryor Street and Central Avenue crossings are at grade, street traffic over the barrier depends mainly on the three viaducts at Forsyth, Broad and Whitehall streets, and the congestion is increased by the fact that Forsyth and Broad streets merge with the Whitehall-Peachtree trunk a short distance each side of the railroads. Along the railroad are unattractive wholesale houses, and the track depression itself is insanitary. Just west of Forsyth Street the tracks flare out into freight terminals which embrace several freight houses, team tracks and a roundhouse—all almost in the center of the city.

For passenger traffic there are two stations, the Union and the Terminal. The former, which is between Pryor Street and Central Avenue, was built in 1871, and is believed to have outlived its usefulness. It has four tracks only, and there is hardly room for more. It is used by the Nashville, Chattanooga & St. Louis Railway and the Georgia Railroad. In 1904 the Terminal Station, on Mitchell Street west of Madison Avenue, was built. This station, while modern in most respects, the report criticizes for shortness of tracks and platforms; presence of sharp approach curves, necessitating much switching; lack of satisfactory facilities for handling baggage and mail, and other objectionable features. Furthermore, while the building could be readily enlarged, the trackage could not. Consequently the conclusion was reached that it should be abandoned as a station.

EARLIER PLAZA SCHEMES

In 1912, before Barclay Parsons & Klapp were asked to study the situation, Haralson Bleckley proposed to the city that the tracks between Washington and Forsyth streets be covered, and in 1913 Capt. R. M. Clayton, chief of construction of the city, and C. E. Kauffmann, engineer of bridges and estimates, prepared a comprehensive design on the Bleckley plan, together with an estimate calling for $3,000,000. A bill was presented to the state Legislature to enable the city to carry out the scheme, but it failed to pass. This plan made it possible to add one or two tracks to the Union Station.

While the New York firm considers this plan excellent structurally, it does not believe it practicable to cover the existing tracks and operate the trains by steam. It is held that even if the system of ventilation were ordinarily effective it would not always be so, and that at times the smoke would be extremely objectionable to the traveling public and to the occupants of the abutting buildings. The ventilation problem would be worse at stations—in fact, it is believed no station could be ventilated unless its tracks were outside of the covered zone. The drafts necessary to ventilate the tunnel would constitute a serious menace in case of fire. On the other hand, electrification of the tunnel would entail a prohibitive cost on the railroads. In any event trees could not be grown on the concrete roof except with a prohibitive thickness of earth, and so the park would lose much of its effectiveness. Furthermore, the nuisance of the freight yards just west of Forsyth Street would continue.

ADVANTAGES OF NEWEST PLAN

By the plan recommended in the report the ventilation problem and that of the cramped terminals are solved, while the plaza feature of the Clayton-Kauffmann plan is retained—on a larger scale, in fact. Also, the freight terminals just west of Forsyth Street are moved westward out of the business district and the offensive engine house is eliminated. One of the accompanying drawings shows the proposed layout. The existing facilities to be displaced are shown in dotted lines. The new union station would be located about 900 ft. northeast of the present Terminal Station, on the site of the roundhouse of the Western & Atlantic Railroad. The station would have twenty through tracks, and ten platforms from 800 to 1000 ft. long. The displaced freight facilities of the Western & Atlantic, Central of Georgia and Seaboard Air Line railways would be relocated on 5 acres of land between Elliott and Hulsey streets, to the east of the four tracks and right-of-way at present owned by the Southern Railway.

TUNNEL FOR TWO TRACKS ONLY

Two or three tracks only, each in a separate tunnel, would be carried through from Washington Street to the north end of the new union station layout, affording at once

OLD UNION STATION, SURROUNDED BY STREETS AT GRADE, CANNOT BE EXPANDED an entrance to the station for passenger trains from the east and interchange facilities for freight. With separate tunnels it is held that trains would drive the smoke out ahead of themselves. Aside from these tunnel tracks, all tracks, industrial as well as those of the present Union Station, would be abandoned in this area; retaining walls would be built along the right-of-way lines and the whole area would be filled in and converted into a park. The tunnel tracks would be depressed a maximum of about 12 ft. to a new profile with grades not exceeding 0.5 per cent, so that Pryor Street and Central Avenue could be carried over on easy grades, while Forsyth, Broad and Whitehall streets could be lowered slightly as compared to the height of the present viaducts.

The new plans terminate the tunnel and the plaza over the tracks at Central Avenue instead of at Washington Street, to which the Clayton-Kauffmann plan extended the covering. Otherwise the plaza of the new plan includes all of the area contemplated in the Clayton-Kauffmann scheme and a much larger area west of Forsyth Street and south along Madison Avenue. Spring Street would be extended to run past the new station and join Madison Avenue near Mitchell Street, and it is believed many of the street-railway cars now using one of the three viaducts could be rerouted to run past the station, especially if a suggested short extension of Madison Avenue and a one-block diagonal connection from Spring Street were made to connect this new route direct at each end with the Whitehall-Peachtree trunk. Cone Street would also be extended across the plaza to Madison Avenue.

Freight Layout Only a Suggestion

The new freight layout along Elliott Street is not offered as the detail solution of this phase of the problem. The report points out, however, that there is room between Elliott and Hulsey streets to replace the supplanted freight houses and team tracks according to the desires of the three railroads concerned on relatively low-priced land, while the cost of the remaining properties between the passenger and freight layouts would not be prohibitive in case future growth made the expansion of either layout desirable.

While the trainshed of the Terminal Station could not be utilized in the proposed improvement, the report proposes that the headhouse be moved east about 90 ft. and converted into a museum or other public building.

As the plans have been drawn no side tracks are left to the industries along the proposed tunnels. The consulting engineers believe that these industries, mostly wholesale houses, are out of place in what should be exclusively a retail district, and should be relocated elsewhere. At the same time they concede that it would be feasible and not necessarily undesirable for those east of Pryor Street to remain, provided their sidings were separate tunnels.

Estimated Cost of Project

Exclusve of the cost of tracks, signals and auxiliary buildings for the new passenger layout the estimated cost of the project is $6,500,000. The estimate includes trackage as well as land to replace the freight terminals of the three roads supplanted, together with the purchase of the present terminal and necessary land, the construction of the tunnels, adjustment of grades, filling in of ground, development of plaza, construction of new station and moving of present station to proposed location for use as a museum or other public building.

The total cost should, the report states, be divided into two parts—the terminal proper and the plaza. No attempt is made to draw a precise line between the two, but it is suggested that a fair division would be about $4,000,000 for the terminal and $2,500,000 for the plaza. It is recommended that the city finance the entire project, the railroads to pay in rental a sufficient annual sum to take care of the bond interest and sinking fund on the terminal project proper, as well as the cost of operation, the bonds to run for fifty years. If the scheme is carried out the engineers think the city will have an adequate terminal for an indefinite time to come.

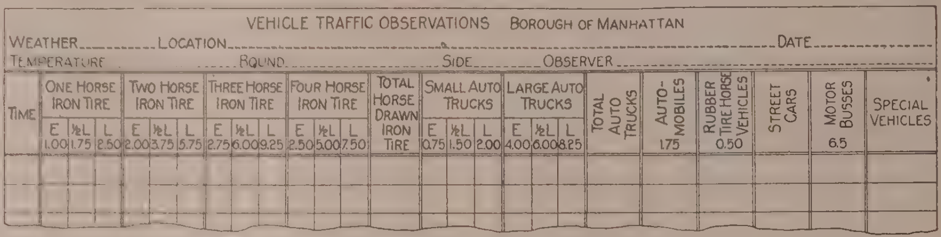
Changes Suggested in Traffic-Census Forms

Standards of American Society of Municipal Improvements Held to Be Unsuitable for City Work—Forms Used in New York City Explained

By DANIEL B. GOODSELL

In Charge of Traffic Division, Bureau of Highways, Manhattan, New York City

CERTAIN revisions are necessary to adapt to city use the standard forms for traffic counts prepared by the committee of the American Society of Municipal Improvements (see Engineering Record of Nov. 18, page 621). Presumably these forms are designed to be suggestive and suited to the traffic of trunk line roads. The following criticism, however, is directed from the standpoint of intensive city traffic work, and it is hoped that it will encourage further discussion. The most serious faults with the committee's standard forms are the arrangement of the headings on the small card and the rather confusing vehicle classification on the two cards.



VEHICLE TRAFFIC OBSERVATIONS BOROUGH OF MANHATTAN

WEATHER........ LOCATION........ DATE........

TEMPERATURE .... ROUND........ SIDE........ OBSERVER........

Time	One Horse Iron Tire			Two Horse Iron Tire			Three Horse Iron Tire			Four Horse Iron Tire			Total Horse Drawn Iron Tire	Small Auto Trucks			Large Auto Trucks			Total Auto Trucks	Auto-mobiles	Rubber Tire Horse Vehicles	Street Cars	Motor Busses	Special Vehicles
	E 1.00	½L 1.75	L 2.50	E 2.00	½L 3.75	L 5.75	E 2.75	½L 6.00	L 9.25	E 2.50	½L 5.00	L 7.50		E 0.75	½L 1.50	L 2.00	E 4.00	½L 6.00	L 8.25		1.75	0.50		6.5	

FIG. 1—FIELD CARD IN EACH SQUARE OF WHICH IS PLACED THE NUMBER OF VEHICLES WITH THE CORRESPONDING WEIGHT

A Better Classification

The first form (small card) is suited to recording a traffic very limited in its classification and should at least have a blank line under both the rubber and iron tire divisions to record unclassified vehicles, such as traction engines, trailers, motorbuses, or other heavy units.

A better classification would seem to be as follows: Horse-drawn, iron tire (subdivided); horse-drawn, rubber tire; automobiles (subdivided); auto trucks (subdivided); autobuses; street cars; unclassified. This is the classification used in Manhattan and it would seem to fit road traffic as well.

If it is desired to ascertain with reasonable accuracy the number of vehicles per foot of width per minute, an interval of less than 1 hour is necessary unless the number of vehicles is very small. City work will require 15-minute periods for traffic of 100 tons or more per foot of width per day of 10 hours, and trunk-line roads would require the same. For comparison with other cities the writer believes that a 10-hour period is better than the 11-hour period shown on the forms, as the 10-hour is commonly used.

No space is assigned on the small card for a record of grade or width of roadway, which should be here for convenience in computing the tonnage per foot of width.

The connecting link between the first and second forms, a table of weights of the classes of vehicles shown, should have at least been referred to and its importance emphasized.

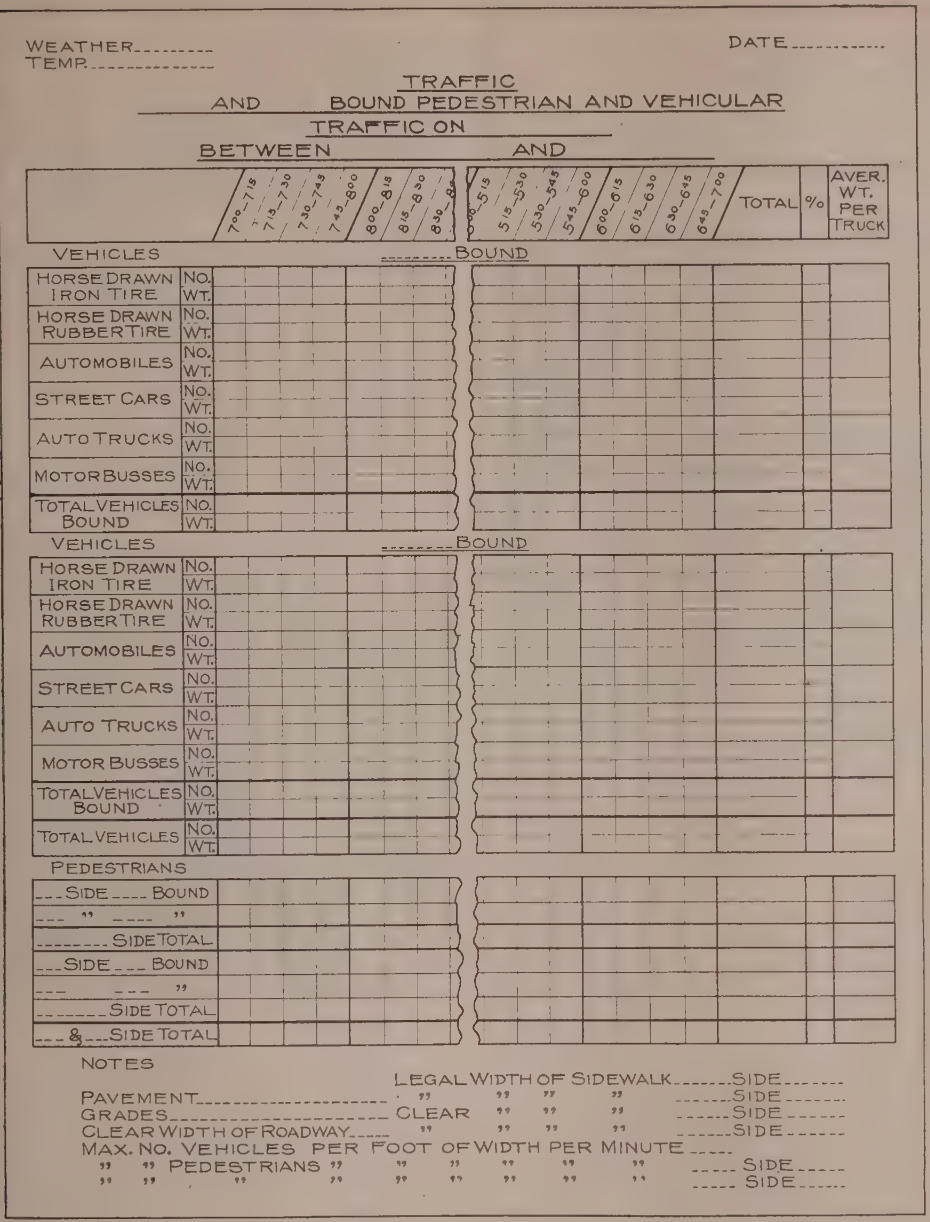
No provision has been made on either form for noting the flow of traffic. This phase of census taking may be important in determining the width of a proposed roadway. A separate card is apparently intended to be used for each direction, and if this be so the two cards of the opposite directions should be in the form of a folder.

The classification of vehicles on the large card is made into "horse and motor," whereas the small card is "iron tires" and "rubber tires," an inconsistency likely to be confusing because they overlap. The large card contains space which is likely to be little used, as this use depends on the number of observations which are made on the same street. Most engineers are obliged to be content with one census. The card should not, in any event, be made more than seven lines deep, allowing for each day in the week. A blank space should be left at the bottom for a sketch showing dimensions of the street at the place at which the census was taken.

The headings "Vehicle Data" and "Tonnage Data" should be "Vehicle Census" and "Tonnage Census," and a suitable heading for the columns on the right, which have no heading, would be "Congestion." All these headings should be printed in bold letters and capitalized.

Two columns are left blank on the right-hand side of the small card, presumably for computing tonnage; the space is too small and, moreover, three are needed. For convenience in summing up, the side headings of the small card should have been placed at the top and the hours at the side, as the sums under the vehicle classification are used more frequently.

The forms are probably not intended for strictly city use and are certainly not fitted



WEATHER---------
TEMP.-------------

DATE-----------

TRAFFIC
AND BOUND PEDESTRIAN AND VEHICULAR
TRAFFIC ON
BETWEEN AND

		7^{00}–7^{15}	7^{15}–7^{30}	7^{30}–7^{45}	7^{45}–8^{00}	8^{00}–8^{15}	8^{15}–8^{30}	8^{30}–8	–5^{15}	5^{15}–5^{30}	5^{30}–5^{45}	5^{45}–6^{00}	6^{00}–6^{15}	6^{15}–6^{30}	6^{30}–6^{45}	6^{45}–7^{00}	TOTAL	%	AVER. WT. PER TRUCK
VEHICLES		---------BOUND																	
HORSE DRAWN IRON TIRE	NO.																		
	WT.																		
HORSE DRAWN RUBBER TIRE	NO.																		
	WT.																		
AUTOMOBILES	NO.																		
	WT.																		
STREET CARS	NO.																		
	WT.																		
AUTO TRUCKS	NO.																		
	WT.																		
MOTOR BUSSES	NO.																		
	WT.																		
TOTAL VEHICLES BOUND	NO.																		
	WT.																		
VEHICLES		--------BOUND																	
HORSE DRAWN IRON TIRE	NO.																		
	WT.																		
HORSE DRAWN RUBBER TIRE	NO.																		
	WT.																		
AUTOMOBILES	NO.																		
	WT.																		
STREET CARS	NO.																		
	WT.																		
AUTO TRUCKS	NO.																		
	WT.																		
MOTOR BUSSES	NO.																		
	WT.																		
TOTAL VEHICLES BOUND	NO.																		
	WT.																		
TOTAL VEHICLES	NO.																		
	WT.																		
PEDESTRIANS																			
---SIDE ----BOUND																			
--- " ---- "																			
--------SIDE TOTAL																			
---SIDE --- BOUND																			
--- --- "																			
-------SIDE TOTAL																			
--- & ---SIDE TOTAL																			

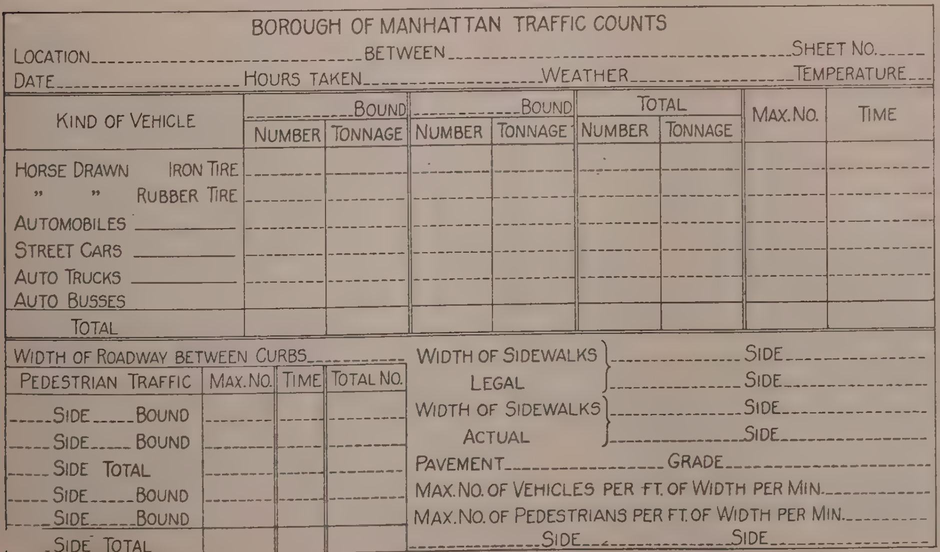
NOTES

LEGAL WIDTH OF SIDEWALK------SIDE-------
PAVEMENT-------------------- " " " " ------SIDE------
GRADES---------------------- CLEAR " " " ------SIDE------
CLEAR WIDTH OF ROADWAY----- " " " " ------SIDE------
MAX. NO. VEHICLES PER FOOT OF WIDTH PER MINUTE-----
" " PEDESTRIANS " " " " " " ----- SIDE-----
" " " " " " " " " ----- SIDE-----

FIG. 2—OFFICE FILE SHEET FROM WHICH TOTALS ARE COMPUTED

for it. Pedestrian-traffic census should invariably be taken where street-widening projects are contemplated.

The writer presumes that these forms are designed to be suggestive and suited to the traffic of trunk-line roads or that of a small city. His criticism is directed from the standpoint of intensive city traffic work, and it is hoped that it will bring out further discussion. The most serious faults from his point of view are the arrangement of the headings on the small card and the rather confusing vehicle classification on the two cards.



BOROUGH OF MANHATTAN TRAFFIC COUNTS

LOCATION---------------------------BETWEEN---------------------------------SHEET NO.-----
DATE--------------------HOURS TAKEN------------------WEATHER----------------TEMPERATURE---

KIND OF VEHICLE	-----------BOUND		-----------BOUND		TOTAL		MAX. NO.	TIME
	NUMBER	TONNAGE	NUMBER	TONNAGE	NUMBER	TONNAGE		
HORSE DRAWN IRON TIRE								
" " RUBBER TIRE								
AUTOMOBILES								
STREET CARS								
AUTO TRUCKS								
AUTO BUSSES								
TOTAL								

WIDTH OF ROADWAY BETWEEN CURBS-----------

PEDESTRIAN TRAFFIC	MAX. NO.	TIME	TOTAL NO.
-----SIDE-----BOUND			
-----SIDE-----BOUND			
-----SIDE TOTAL			
-----SIDE-----BOUND			
-----SIDE-----BOUND			
-SIDE TOTAL			

WIDTH OF SIDEWALKS LEGAL --------------SIDE--------------
--------------SIDE--------------
WIDTH OF SIDEWALKS ACTUAL --------------SIDE--------------
--------------SIDE--------------
PAVEMENT---------------GRADE---------------------
MAX. NO. OF VEHICLES PER FT. OF WIDTH PER MIN.-----------
MAX. NO. OF PEDESTRIANS PER FT. OF WIDTH PER MIN.---------
-------------SIDE-------------SIDE--------------

FIG. 3—CARD UPON WHICH SUMMARY OF DATA IS RECORDED

FORMS FOR NEW YORK TRAFFIC

In order to illustrate the points to which attention has been directed, the forms in use by the Bureau of Highways, Manhattan, are shown. They are not believed to be ideal, by any means, but have been found to be reasonably convenient with the exception of the large sheet. Fig. 1 illustrates the field card. In each square is placed the number of vehicles with the corresponding weight. These are then transferred to the large sheet, Fig. 2, from which the totals are computed. Fig. 3 shows a summary card. The final report is made out in three parts under the headings "Vehicle Traffic," "Pedestrian Traffic" and "Congestion." Under the latter there is shown the traffic peaks for vehicles and pedestrians.

The whole matter of standard traffic forms is of such increasing importance that it deserves careful attention at this time, and the writer therefore offers the suggestion that a joint committee be appointed from the American Society of Civil Engineers, American Society of Municipal Improvements and the American Road Builders' Association to draft and promote the use of standard forms for recording city street and country road traffic and to suggest the weights to be used in estimating the tonnage.

Finder Locates Fires on Single Observation

With Instrument Used Last Summer in Oregon and Washington Site of Forest Fire Is Projected on Topographic Map

A FIRE FINDER used with success the past summer by the 125 lookout men in the National Forests of Oregon and Washington located fires in a few minutes without the necessity of waiting until a second course upon it is reported from another station. It consists of a metal plate 24 in. in diameter, bearing a topographic map of the country visible to the observer. On the outer edge of the map a graduated circle is laid out. The instrument is securely mounted and the map oriented so that the true bearing may be read from the graduated circle on the outer edge of the topographic map. To the center of the plate an alidade is pivoted, consisting of a straight edge and two sights. The plate and alidade may be mounted on a short track, which permits sliding the plate when necessary to avoid a post or window frame in sighting a fire. A simple vertical vernier is attached to the sights, so that the vertical angle of the fire under observation may be determined.

When a fire is discovered the lookout man turns the alidade and reads the true bearing of the fire from the graduated circle, after which the vertical angle is also noted. By referring to the topographic map it is also possible to draw a profile map of the country along the line of sight. Then, by drawing the line of sight as indicated by the vertical angle, the profile is cut at the point at which the fire is burning.

The instrument was invented by W. B. Osborne of the Portland office of the U. S. Forest Service.

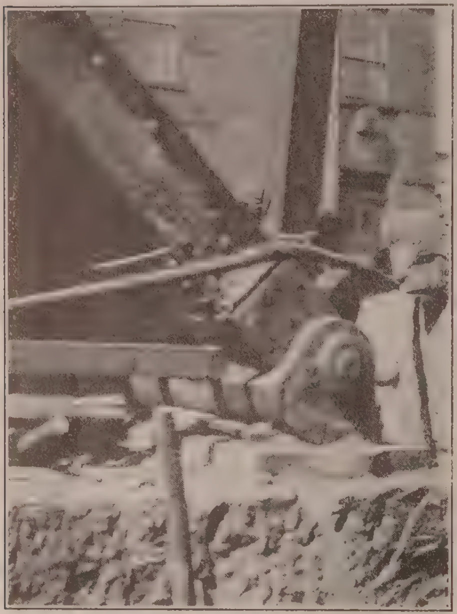
Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Cast-Iron Rocker Shoes

SIR: Inclosed you will find a small photograph of a cast-iron rocker which may be of interest in connection with Mr. Kelley's recent letter (Engineering Record, Dec. 2, page 688) regarding cast-iron rocker shoes. This view was snapped by the writer during the tearing down of the old Congress Street Bridge.

This bridge was built in 1872. The rocker in question supported a 64-ft. pony truss used as an approach to the main spans. The flat bar lying directly in front of the rocker was left by a workman. Otherwise the débris fairly represents the condition of the seat when uncovered. The bridge as a whole was well cared for and in excellent condition, but evidently the shoes were as usual neglected. When torn down it was found impossible to move either the rocker or the truss members on the pin, and it was evident that there had been no "rocking" for many years.


A ROCKER "FROZEN" WITH RUST

To show that the rockers were not alone in their failure to act as intended, it may be said that the 2-in. rollers under the main 240-ft. spans were rusted tight and in many cases had worn to a flat surface more than 1 in. wide.

LEROY W. CLARK,
Assistant Professor of Rational and Technical Mechanics, Rensselaer Polytechnic Institute.
Troy, N. Y.

Camera on Engineering Work

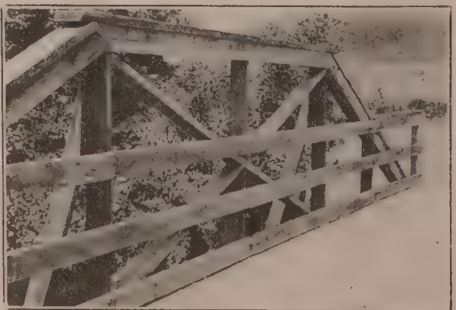
SIR: The contribution of H. Colin Campbell on the camera's use on engineering work in your issue of Dec. 2, page 670, deserves indorsement. Engineers do not realize the latent possibilities of even a cheap hand camera.

I believe, however, from my own experience that Mr. Campbell has not quite touched the vital point. Engineers do not take telling pictures having proper composition as well as adequate exposure not only because they lack artistic sense but also because they have a very definite and proper objection to lugging around even so small a camera as one taking a picture 3¼ x 4¼ in. in size. More annoying than "galluses" is the camera strap that refuses to stay on the shoulder, and this is particularly true in the case of an engineer who has to go in out-of-the-way places, climbing up and down all sorts of improvised ladders, where a camera slung from the shoulder seems fairly possessed to bring about a tumble. Even worse are the reflecting cameras of larger size, such as the 3¼ x 5½-in. (3-A). The 5 x 7 and larger sizes are simply impossible.

In photography, as in hunting, you see the finest shots when you have no gun. The only remedy is to go always armed; and to this end it has been the practice of the writer for five years past to carry continuously a small camera taking a picture 2¼ in. square. This camera is of the highest grade, carrying a Zeiss-Tessar lens and a high-speed shutter. It fits conveniently in a hip pocket and its weight and size are never annoying. With this camera thousands of pictures have been taken by the writer with great success, many of them from the observation platforms of moving trains, this being rendered possible by the use of full aperture (F4.5) and a fast-working shutter.

So far as reflecting cameras are concerned, they are unapproached, particularly for critical studies and high-speed work. There is, however, only one size as made in this country which is compact enough to suit engineering needs; that is the 1-A Graflex. A camera of this size, equipped with lens of F4.5 aperture, has been of invaluable service to the writer.

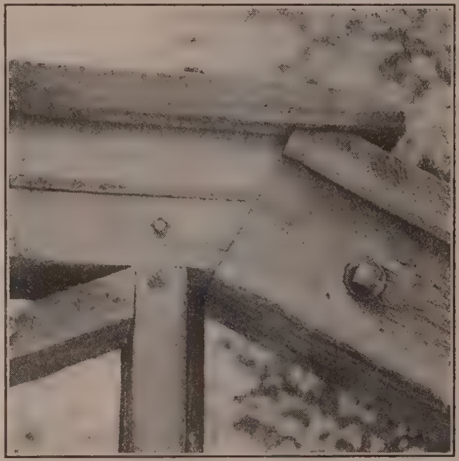
But I believe that in yet another respect Mr. Campbell does not go far enough and misses the crux of the question. Photographs, to be of any service, must be available at any time. To this end all the writer's photographs have been placed on cards and indexed. The back of the card carries a small manila envelope in which is placed the negative, or negatives, if more than one print is on a card. Classified under different heads, they are available for instant reference and have rendered invaluable service. Enlargements of these small films have been made up to 2 ft. square, a magnification of about eleven diameters.


PHOTOGRAPH TO GUIDE THE CARPENTER

Isolated pictures of one kind or another, even though of the best exposure and of the most artistic composition, are of little engineering avail, except as souvenirs. To obtain more than a few pictures the engineer must be prepared to take photographs whenever and wherever subjects in which he is interested may be found. A multitude of pictures taken in this way are of no engineering use unless classified. No way of accomplishing these two desired ends other than the foregoing has occurred to the writer.

NATHAN C. JOHNSON,
Consulting Concrete Engineer.
New York City.

SIR: Apropos of Mr. Campbell's article in the Engineering Record of Dec. 2, on the use of the camera in engineering operations, I wish to offer the following as illustrating one particular kind of service on the part of the camera:


DETAIL OF A JOINT VISUALIZED

When having a number of wooden bridges of 30 and 40-ft. span constructed by different foremen, most of whom were not skillful carpenters, I took pictures of the special features that I wanted used from a bridge that I had already built. The new men readily understood how to make the joints and put on the braces, when they would have had difficulty in understanding a blueprint.

I will say further in regard to the type of top chord and end post shown that we are not troubled by their warping. The top member overlaps on sides and ends and protects the joints underneath from holding water.

For making pictures of details I use a little portrait lens that slips on over the regular lens. It in no way affects the operation of the lens, except that the distance must be measured carefully according to the tables of distances sent with the lens. After the negative is made any number of blueprints may be made as from a drawing. Thus directions may be given to workmen in this manner often at less expense than if drawings were made. And a picture will show more to the average foreman than half a dozen drawings.

Allow me to say that I find the Letters to the Editor and the Hints for the Contractor sections the most interesting and helpful parts of your magazine to the man dealing every day with the "little things" in construction work.

R. T. BROWN,
Engineer, Board of Road Commissioners, Davidson County, North Carolina.
Lexington, N. C.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*

Steel Sheeting Driven Cheaply Under Water with Two Rigs

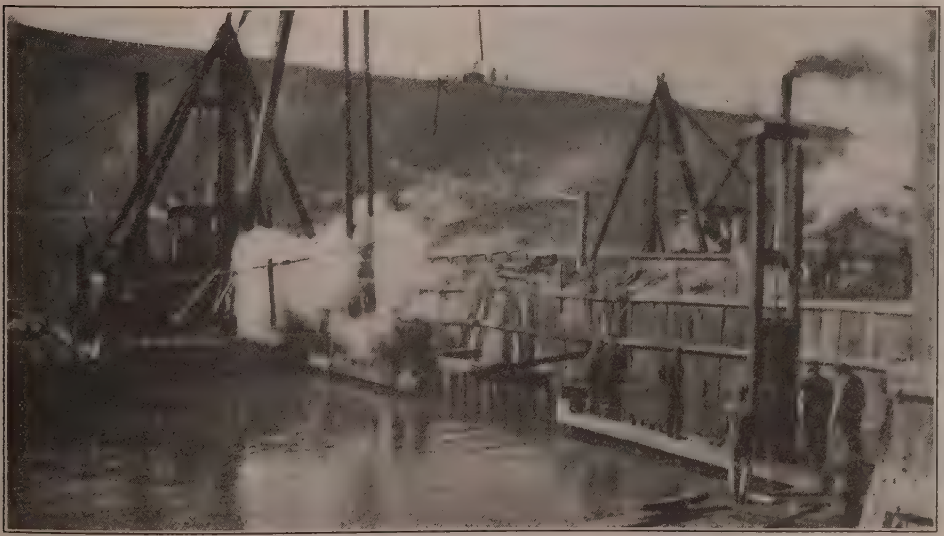
By GEORGE W. McALPIN
Junior Engineer, Government Dam 35,
New Richmond, Ohio

BY SETTING sheeting and driving it down to water with one derrick boat and following the piles down to grade with a second rig, rapid progress has been made at Government Dam 35, on the Ohio River, in driving 14-in. arch-web Lackawanna steel piling. Each of the derrick boats was equipped with swinging leads supported in driving on 10 x 12-in. runway timbers about 30 ft. long, spaced 6 in. apart.

The runways were similar to those used for driving round piles at the same dam, described by the writer in the Engineering Record of July 1 last, page 25. One end rested on a timber suspended by chains over the front end of the derrick boat, the other being carried on the sheeting already in place by a cross-timber bolted on 10 x 12-in. blocks at that end of the timbers. Piles were driven the length of the runways, the latter lifted and moved forward with the pile line as the boat moved, and again set in position with the cross-timber resting on the last pile driven.

Trouble with the piling creeping ahead at the top was overcome by inserting in each interlock as the piles were set a hook of ¾-in. round iron so that it caught under the bell of the pile being driven, and was carried down with it. These hooks were placed so as to spread the piles. In addition to them, ordinary railroad spikes were inserted at the top of the interlocks after each pile was driven, in such a way as to hold the piles closer together.

The follower used by the second boat was a pile of the same section as those being driven. To its lower end were riveted plates cut from the web of an old pile, making a slot to hold it in place. The sheeting was driven into sand and gravel to a penetration averaging 30 ft. Under these conditions the two boats placed and drove to grade an average of 20 piles per 8-hour shift, the cost of driving being about 20 cents a foot, or about one-half cent a pound.

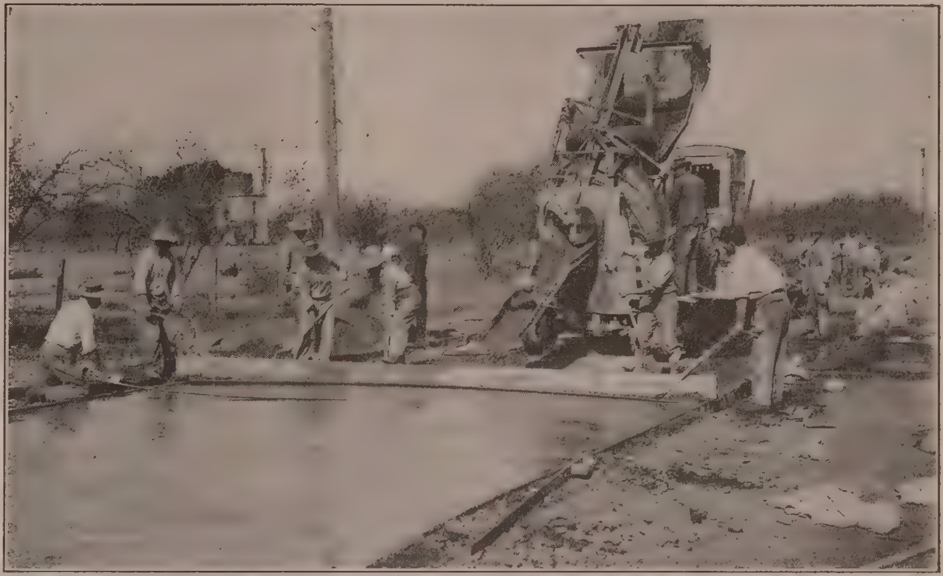


FIRST BOAT SETS AND DRIVES PILES TO WATER, SECOND FOLLOWS THEM TO GRADE

Plow Handle Tamper and Lengthy Floats Finish Concrete Road

By LESTER H. MORRIS
Inspector, Saratoga-Mountain View Road,
Cupertino, Cal.

THE plow handle tamper adopted as a standard tool for concrete-road construction by the California State Highway Commission and one of the long, flexible redwood floats also in general use in the state are shown in action in the photograph. The tamper was invented by Stanley Hall, foreman for a contractor on state road work, three years ago, at a time when the commission was using several different methods of finishing concrete roads with indifferent results. The tamper consists of a pair of plow handles made of 1-in. pipe attached to a striking template shod with iron and sufficiently heavy and stiff not to bend when used to drag a mass of concrete to the required crown.



LONG FLOAT AND COMBINED TAMPER AND STRIKE BOARD FINISH SURFACE QUICKLY

To get the best results with this tool the concrete is mixed so dry as to flow slowly down the chute of an ordinary paving mixer. The chute is swung sidewise, distributing the concrete swath somewhat higher than the required surface. The man on one end of the tamper rides his handles, while the other, assisted by the three spreaders with their shovels, drags his end sidewise on top of the side form. After the other end of the tamper has been pulled ahead in the same way, the concrete is pounded with an up-and-down motion until the water flushes to the surface. The results secured by this method are so good that little finishing is required with the long redwood floats. Two of these are employed, one a foot longer than half the width of the pavement and the other 2 ft. 3 in. long for finishing at the sides. The long float is so light and flexible that it fits any crown without disturbing the surface left by the tamper. These floats are inexpensive and easy to renew, and their use eliminates the necessity for a bridge. One operator can finish the surface of a 4-in.-thick concrete road as fast as it can be laid by using a mixer of the two-bag-batch size.

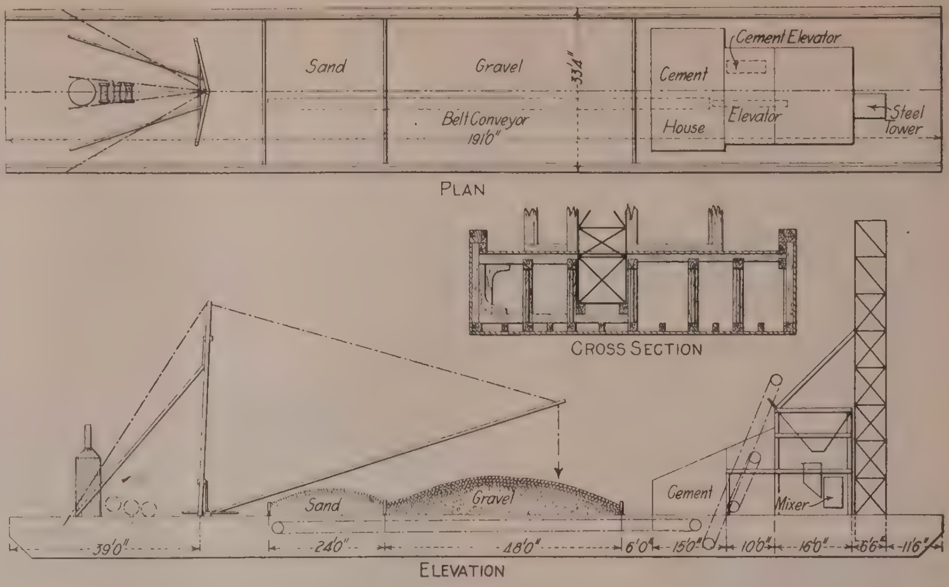
Many miles of concrete road laid in this way have been opened to traffic for from six to nine months before being surfaced with a ⅜-in. carpet of oil and screenings. Expansion joints are left at intervals of 16 to 30 ft., and are usually filled with an asphalt compound before the carpet is applied.

Mixer Boat Has Sand and Gravel Storage on Decks

IN BUILDING the floating concrete plant in use on the Thames River bridge at New London advantage was taken of the length of an old car float secured in New York harbor to place a mixer and tower on one end and a derrick on the other, and still provide ample space between on the deck of the boat for sand and gravel storage. In this way topheavy bins were not required to make sure of continuous running. Small sand and gravel bins over the mixer are supplied by a bucket elevator. This in turn is loaded by a belt conveyor passing lengthwise of the sand and gravel storage space under the deck. Cement is raised to the charging platform by an elevator from a one-car cement house behind the mixer. The speed of this conveyor is timed so that it supplies cement almost exactly at the rate of mixing.

The plant is arranged for pouring 300 yd. in 10 hours, at which rate the chutes are full continuously. It usually runs a little faster than this and has placed 282 yd. in eight hours on the Thames River bridge, described on page 737 of this issue. It was built and used first, however, on the bridge at Portland, Me., described in the Engineering Record of March 4, 1916, page 319, from where it was brought down the coast to New London by a tug last spring.

The Holbrook, Cabot & Rollins Corporation contracted for both bridges, and work on the first, as well as on the second bridge, was in the charge of L. S. White, superintendent.



TOPHEAVY BINS AVOIDED BY DECK STORAGE ON LONG FLOATING CONCRETE PLANT, MATERIALS BEING REHANDLED TO MIXER BY CONVEYORS

Handy Trailer Furnishes Hot Oil for Small Jobs

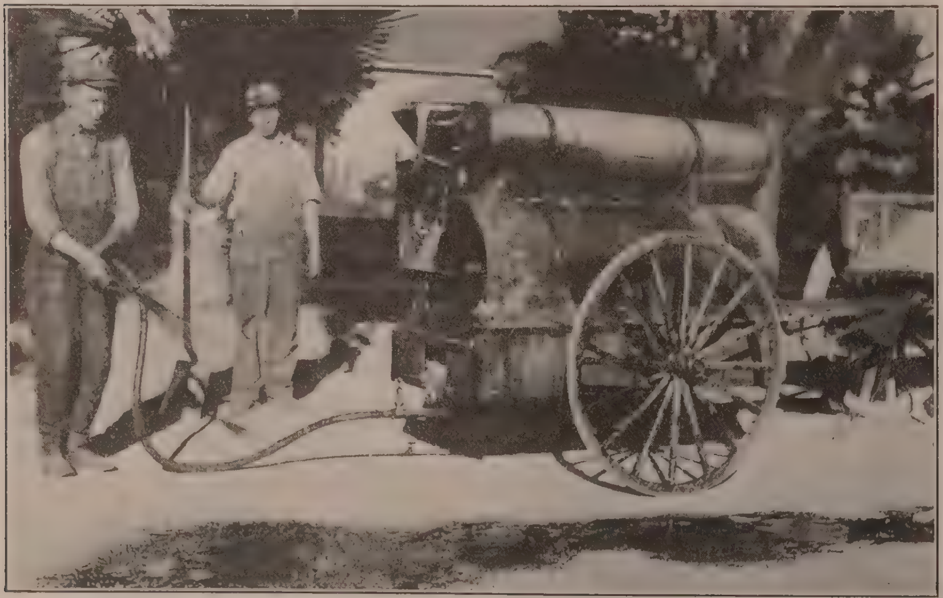
IN MAINTAINING the 120 miles of oiled pavement which have been put down in Riverside, Cal., it was found that there was often need for comparatively small quantities of oil that could be applied hot. After some study, a 100-gal. tank was mounted on a firebox and the whole supported on a pair of wheels. This could be attached as a trailer to the wagon in which equipment and materials were hauled to the job, and hot oil was drawn off in buckets as desired.

This worked so well that a smaller tank for compressed air was mounted on top of the oil tank, and by putting pressure on the oil it can now be sprayed from a nozzle, greatly expediting the work. The equipment shown in the illustration was built in the city's repair shop as the idea developed, and only such material as was conveniently at hand was used. If designed anew, however, a compressed air compartment might as well be provided for within the oil tank.

The tank here shown was strong enough for air pressures of only 100 lb. per square inch. The air tank has two ¾-in. pipe connections, each provided with a globe valve. One is arranged to be conveniently connected with the reservoir of the air compressor at the shop before the trailer is sent out. The other is a short connection between the two tanks. Oil is pumped into the larger tank through a 1½-in. pipe at the head end, and discharges through an elbow of the same size on the under side at the rear.

In addition to the globe valve on the discharge pipe there is another at the end of the hose, so that the operator can turn it off instantly when desired. Making for flexibility and convenience of operation, this is said to save much time. In fact, the time saving is such that another tank trailer is to be built on a larger scale, so that it will carry enough oil and air for an entire day's work, thus obviating the necessity of returning to the shop during working hours and making the equipment suitable for continuous service.

The device has been designed by W. V. Darling, superintendent of streets of Riverside, Cal.

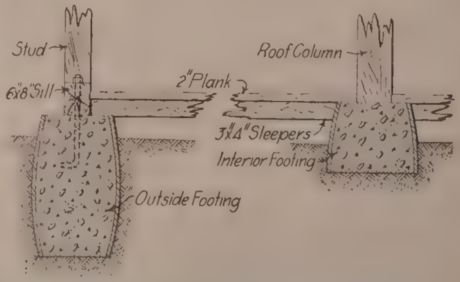


HANDY TANK FURNISHES HOT OIL UNDER PRESSURE FOR MAKING PATCHES

Forms of Old Barrels Lower Cost of Concrete Footings

By C. D. ACKER
Rochester, N. Y.

TIME and expense were saved by using old oil barrels for footing forms recently in constructing a building for the Vacuum Oil Company at Rochester. The barrels used were 17 in. in diameter at the top and bottom, 19 in. at the center and 34 in. in depth. Around the outside of the building whole barrels were used, deeper footings being required to prevent movement from frost action. The forms for the interior footings were made by sawing the barrels in half at the bilge and placing the halves with the large end down. The interior footings are, of course, protected from frost action by the flooring. This method used by the writer effected a great saving both in material and labor on the forms for these footings. As the barrels selected were old ones, they were left in the ground permanently.



OLD BARRELS AS CONCRETE FORMS

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Arch Design Recommended for Galveston Causeway

Careful Estimates of Cost by Arbitration Board Show Arch Design $141,000 Less Than Girder Design

On Dec. 4 the board of arbitration in the Galveston causeway reconstruction controversy made a unanimous report to the board of engineers, consisting of one representative from each of the five interests involved, and recommended the adoption of the 60-ft. arch design submitted by William Mueser, of the Concrete-Steel Engineering Company, New York City. The alternate design of 30-ft. curved girders submitted by J. L. Harrington of Kansas City, Mo., was estimated to cost, with recommended changes, $141,000 more than the arch plan. Through the courtesy of F. Merritt, chief engineer of the Gulf, Colorado & Santa Fé Railway, and chairman of the board of engineers, a copy of the report has been furnished to the Engineering Record, and the following abstracts show the estimated saving resulting from the arch type and the recommended changes. The reasons for these proposed changes and the details of the design will be published in a later issue. A description of the damages to the causeway in the Galveston storm will be found in the issue of Aug. 28, 1915, page 271.

60-Foot Reinforced-Concrete Arch Plan

As noted on page 185 of the issue of Aug. 5, and page 335 of the issue of Sept. 9, the arbitration board was composed of Prof. A. N. Talbot of the University of Illinois, chosen by the three railroad interests; Prof. George F. Swain of Harvard University and the Massachusetts Institute of Technology, chosen by the interurban railway and the county, and Lincoln Bush, consulting engineering, of New York City, selected by the other two members and acting as chairman.

The report of this board, made after careful estimates and investigation, says: "We hereby determine and adjudge that the arch type of structure submitted by the Concrete-Steel Engineering Company, with certain modifications in details which will be hereafter referred to, is the type of structure which should be adopted.

"We estimate that the cost of the arch plan as submitted to us, including all overhead charges of every kind, but excluding the cost of repairs to the 2300 lin. ft. of Galveston approach, will be $1,344,000."

The board then recommends that certain modifications be made in the arch plan as submitted, the total estimated cost of these changes being $32,300, including additional arch reinforcement, widening the pier bases and richer concrete for piers, abutments and retaining walls. This added to the original estimate totals about $1,376,000. Thus the cost of the work is $16,000 in excess of the $1,500,000 limit, when $140,000 is allowed for the repairs to the Galveston approach. The latter sum, however, according to opinion expressed at the arbitration hearings, could be materially reduced.

Girder and Slab Plan

The board of arbitration estimates the cost of the 30-ft. girder and slab plan to be $1,431,000, but says: "Certain modifications, however, would have to be made in this plan to meet engineering requirements that we consider essential. These modifications include a considerable addition to the number of piles, increasing the size of the transverse diaphragms, lengthening the piers, and the addition of reinforcement and concrete in certain parts of the structure. The estimated cost of these items is about $86,000, bringing the total cost of this plan up to about $1,517,000. This estimate will make the total cost of the work $1,657,000, provided that the $140,000 is necessary for the repairs to the Galveston approach.

The report concludes with the following: "In other words, the cost of the girder plan is estimated at $141,000 more than the cost of the arch plan, and considerably in excess of the $1,500,000 limit.

"In connection with the above estimates we desire to suggest to the board of engineers that it consider carefully the desirability of substituting creosoted wooden piles for concrete piles. If this substitution were made, we estimate that it would afford a saving in the arch design of $76,000.

"From our analysis and study, from an engineering point of view, of the two plans presented, and from our estimates of cost, we determine that the arch design is the least expensive and that it represents the better structure and the one most suitable for the conditions."

Year-Old Corporation Active in All Parts of World

American International Corporation's Business of Wide Variety—Large Engineering Projects Undertaken

The American International Corporation, organized Nov. 15, 1915, with a capital stock of $50,000,000 has, according to the preliminary report of the president just issued, earned in excess of organization and operating expenses an estimated surplus of $2,231,495. The appreciation which has accrued from the corporation investments is not included in that figure except so far as the securities have been placed or otherwise disposed of. A dividend of 75 cents per share on preferred and common stock has been declared.

1230 Propositions Submitted

From the date of organization to Dec. 1, 1916, 1230 propositions were submitted for consideration, of which 916 have been declined and 313 have not yet been disposed of. Twenty-nine of the proposals were from Africa, 4 from Alaska, 73 from Asia, 10 from Australia, 41 from Canada, 47 from Central America, and 256 from Europe. From Mexico 26 propositions were received, from South America, 347, United States, 326 and West Indies, 71. Transportation propositions formed the majority with a total of 332; of the other proposals 185 were for mining, 143 for agricultural development, 127 for public utility works and the remainder of a more general nature.

The corporation has financed or acquired interest in the Pacific Steamship Company, the Allied Machinery Company of America, the Latin-American Corporation, Rosin & Turpentine Export Company, International Mercantile Marine Company, United Fruit Company, American International Terminals Company, New York Shipbuilding Company, and Carter, Macy & Company, tea importers. The organization has also financed contracts for sewer work in Uruguay and railroad work in China. Investigations in Russia are now being made under the direction of Frederick Holbrook, of Holbrook, Cabot & Rollins.

Fire-Protection Convention Next May

Washington, D. C., has been selected by the officers of the National Fire Protection Association as the place for the annual convention next May. The meeting will last three days, beginning May 8.

Maintaining Cheaper Types Feature of Road Congress

Highway Officials of Middle West Discuss Federal-Aid Problems, Gravel and Macadam Roads and Standardized Bridges

Construction and maintenance of earth, gravel and macadam roads, federal aid and standardized bridges were the topics most discussed at the third annual session of the Northwestern Road Congress in Chicago, Dec. 7 and 8. The registration was about 160, but nearly twice that number were in attendance. Although no exposition was held as part of the congress, several states had photographic reproductions of their work, and a number of material companies and the Portland Cement Association had exhibits on another floor of the hotel. The convention itself was the main attraction and all sessions were enthusiastically attended. The officers elected for next year are as follows: President, A. D. Gash, chairman Illinois Highway Commission; vice-president, Frank F. Rogers, Michigan state highway commissioner; secretary-treasurer, T. R. Agg, Ames, Iowa.

Federal aid and the national road policy under it was the burden of the annual address of John A. Hazelwood, chairman of the Wisconsin State Highway Commission.

States Report Needs

Ten-minute reports from the Middle West states on the history of the road movement, present conditions and needed legislation were conspicuous for the multiplicity of ways by which state highway organizations have taken advantage of such laws as are on the books and are trying to get results.

A big bond issue is needed in Illinois, said B. H. Piepmeier. Two counties are spending money from a bond issue, three more have voted for bonds and fifty are seriously considering it. The resulting problem for the state will be a lack of a connected system, apathy toward a general bond issue and neglect of designated but unimproved state-aid roads.

Iowa has enough legislation now, said John Ames, bridge engineer. She spends $13,600,000 a year under state supervision, but the counties handle the money. Rapid progress is being made toward permanent bridges and culverts and one-half of the above sum goes for 14,000 structures. Grading of a permanent nature, and 15,400 miles of dragging at 71.3 cents per mile are the principal improvements. Federal aid is to be extended on the 5000 miles of through routes on substantial grading and graveling. Frank Rogers of Michigan said that federal aid is to be spent on those parts of the 5000 miles of lines which would not otherwise be improved during the next five years.

Minnesota, said J. H. Mullen, cut off the state highway department's funds last year. The counties, however, liked the work of the state's engineers so well that they were practically all retained and allowed to report to the state, although the counties paid their salaries. Kansas has a state highway department with its hands tied for lack of funds, said Mr. Henderson.

Earth-Road Hints

John H. Mullen, in his paper on earth roads, stated that light crowning permitted persistent dragging, thus maintaining a hard crust. Dragging during construction will prevent longitudinal waves. Hard finishing for the back slopes of ditches more than pays the cost.

Oiling is only a maintenance proposition; that it is a failure as anything permanent was especially emphasized by B. H. Piepmeier in his paper on that subject. He recommends for a first oiling ½ gal. for 15 ft. in the spring and ¼ to ⅓ gal. for a road 10 ft. wide in the fall. This will suppress the dust, waterproof the surface and give a smooth road for 90 per cent of the yearly traffic.

In the discussion H. Frank Holman, Moberly, Mo., explained the results of oiling for three years. He also warned against expecting permanent results. He estimates the expense as $300 per mile.

C. E. Nagel, bridge engineer, Minnesota, explained a system of cheap concrete bridges of cored-out slabs of uniform spans on simple concrete pile bents. The type has been used with success in the Philippines, said Mr. Davis, who was formerly with the Public Works Department. Since placing eight years ago no failures have been reported. The heavy equipment necessary is a serious objection, said M. H. Torkelson, bridge engineer of Wisconsin.

The method of constructing and maintaining gravel roads in the latter state was described in detail by J. I. Donaghey.

In Minnesota, said Mr. Mullen, a team patrol system is employed, each team handling 4 to 10 miles. The patrol system permits of lighter construction. Mr. Mullen advocates 800 to 1600 loads per mile and adding 100 loads per year, as he says that much is lost.

Maryland Macadam Maintenance Nearly Ideal

H. G. Shirley's explanation of his macadam-road patrol system in Maryland was the sensation of the program. Light oils instead of water for original construction, for waterproofing on the bottom course, and asphalt on the upper layers for adhesion, are points emphasized in construction. The practice of picking patrolmen from the likely workmen on the original construction and the subsequent method of handling them outside of politics merits repetition in other states, seemed to be the general opinion. Vigorous maintenance is practised during the first year. After rains the patrolman marks low spots with kiel, never permitting any holes to develop deeper than ½ in. A traveling inspector looks over the physical condition of the patrolman and his outfit. He gives no orders but if his report, which goes to the resident engineer, who has three to four counties, and then to Mr. Shirley, is not satisfactory he is dismissed. Levels are being taken every six months of many controlled cross-sections to determine external wear so this amount of material can be put back.

Concrete Roads and Motor Trucks

In maintenance work Mr. Shirley is using stone as large as 1½ in., rolled down with a minimum of oil (¼ to ½ gal.) by a 10 or 12-ton roller. On the ton-mile basis an oil-macadam road near Baltimore carrying 4000 tons per mile per day is carrying traffic cheaper than any other road in the state, with one exception. It cost $1100 to maintain and the cost per ton-mile is 0.15 cent, while the average in the state is 0.3 cent.

A. N. Johnson, in describing concrete-road construction, said that if water cost $5 a barrel better concrete would result. He recommended that construction be stopped in the early fall and mentioned belt finishing and the roller scheme used in Macon, Ga. He believes in placing a narrow single way slab on one side of the center of a roadway.

Milwaukee County is not worrying about destruction of its concrete roads by tractors, trucks and trailers, as the destruction of the machinery is too rapid, said H. J. Kuelling. An automatic mixer timing device by means of which the discharge chute cannot be operated until the requisite turns have been given, was noted.

Monolithic brick pavements were described by E. B. Schmidt. No one offered any remedies to P. C. McArdle's inquiry as to how to maintain a grout-filled brick pavement which shows tendencies, after several years, to buckle.

Chicago Sanitary District Using Too Much Water

Report States Level of Lakes Would Be Lowered by Increased Diversion to an Extent That Would Harm Navigation

Charges that the Sanitary District of Chicago has persistently violated federal regulation of the drainage-canal flow from Lake Michigan and contemplates still further diversion to the injury of lake commerce are contained in the annual report of the chief of engineers, U. S. Army, made public last week. It is alleged that the contemplated diversion of 10,000 sec.-ft. instead of 4167 now permitted would lower the lake level 5 in. and prevent navigation by deep-draft vessels in harbors on which $90,000,000 has been expended.

Some method of disposing of sewage other than dilution, it is thought, should be adopted. Although the Secretary of War has fixed the limit of diversion at 4167 ft. per second and has repeatedly refused to grant an increase, the Sanitary District has for many years, the report states, been withdrawing a much larger amount of water. It has been shown that since 1910 the average daily flow through the Chicago River into the canal has been in excess of 7000 cu. ft. per second, which represents a daily average withdrawal from Lake Michigan of nearly 690,000,000 cu. ft.

The continuous withdrawal of this volume of water, it is feared, will result in the permanent lowering of the surface of Lakes Michigan and Huron to the extent of 5 in. or more and of Lake Erie to nearly the same extent. This lowering of the water surfaces would reduce the permissible load of large modern vessels, which would mean a loss to navigation of about $1,500,000 a year.

Rogers Pass Tunnel Opened

The Rogers Pass tunnel under Mount MacDonald in British Columbia has been opened for traffic by the Canadian Pacific Railway. It was expected that the work would be completed by Jan. 1, 1917. The unusual method of constructing the 5-mile tunnel was described in the Engineering Record for Dec. 5, 1914, page 604. The cost of the job was $6,500,000.

Minnesota Waterworks Men Organize Branch and Elect Officers

At a meeting Dec. 2 in Minneapolis the Minnesota branch of the American Waterworks Association was organized. After the business had been transacted the problems of the waterworks executive were discussed by G. O. House, general manager of the St. Paul water department. John Wilson, consulting engineer, of Duluth, emphasized the fallacy of extending service connections to the curb line previous to paving and H. A. Whittaker, director of the division of sanitation, Minnesota State Board of Health, detailed state supervision of public water supplies in Minnesota.

The officers elected are: President, F. W. Cappelen, city engineer of Minneapolis; vice-president, G. O. House, general superintendent of the St. Paul waterworks; treasurer, W. R. Young of the Minneapolis waterworks department; directors, William Todd of Austin, Minn., L. A. Gordon of Little Falls, Minn., and D. A. Reed of Duluth. About thirty waterworks men attended the meeting, twenty of whom are members of the parent organization. Two meetings will be held every year, one outside of Minneapolis.

Highway-Engineering Instruction Conference December 29

To discuss highway-engineering instruction in the educational institutions of the United States, with a view to determine how to meet the growing need for road construction engineers, a conference will be held Dec. 29 in the Automobile Club of America, New York City.

Will Open Fremont Avenue Bridge Over Lake Washington Canal February 1

The Board of Public Works of Seattle has fixed Feb. 1 as the date for the formal opening of the Fremont Avenue bridge across the Lake Washington canal and has notified the contractors that the work must be finished by that date. In case the approaches are not completed, the contractors will be required to keep at least a part of the roadway open for traffic. This action was taken by the board after a special committee had reported on bridge construction progress, and recommended that A. H. Dimock, city engineer, be directed to begin work immediately on a draw in the Latona bridge at Sixth Avenue, N. E., to be maintained until the new bridge at Tenth Avenue, N. E., is completed, probably early in 1919.

Will Remove Colorado River Dam Before January 1

The Imperial Irrigation District recently issued instructions to C. R. Rockwood, chief engineer, to remove the temporary dam which was installed in the Colorado River to relieve the water shortage last summer. The work is to be completed before the first of the year and is to conform with the requirements of the War Department and with the terms and conditions of the bond given to the Yuma County Water Users' Association.

New York Section of Waterworks Association Meets December 20

The New York section of the American Waterworks Association will meet Dec. 20 in the Hotel Astor, New York City. After luncheon Prof. Albert F. Ganz of Stevens Institute of Technology will lecture on electrolysis as it affects waterworks men. A general discussion will follow.

Rain Floods California Tunnel

A rise in the Sacramento River Dec. 3, caused by heavy rains, washed out the temporary dam at the north portal of the Anderson-Cottonwood Irrigation District's tunnel near Redding. The tunnel, which is closed at the south end, was filled with water. Cementing of the interior, which was about one-third completed, cannot be resumed until another dam is built and the tunnel pumped dry.

Progress on Alaska Railroad Not Slower Than Expected

Newspaper reports that the completion of the Alaska Railroad through to Fairbanks is likely to be delayed several years beyond the time originally estimated are denied by W. C. Edes, chairman of the Alaskan Engineering Commission. In response to an inquiry from this journal Mr. Edes states that no definite time has ever been fixed for the completion of the line. Inquiries have been answered by the statement that the commission hoped to reach Fairbanks by the end of 1919, although this was largely dependent on favorable conditions and the supply of labor.

"Nothing," writes Mr. Edes, "has occurred this season to discourage us in any way. Like all other enterprises, we have felt the effect of high freight rates and a scarcity of shipping. Possibly we have felt this somewhat more than others, as practically everything used in the construction of the road has to be brought by water from Pacific Coast ports. The past season was also a wet one in Alaska, with numerous storms, which occasioned some changes in our plans.

"By Dec. 30 about 65 miles of new track will have been laid for the season, making 85 miles in all, extending in both directions from Anchorage. In addition to this over 60 miles of right-of-way has been cleared on the line between the end of the track and Fairbanks, and over 35 miles of grading done in disconnected sections. Large additions have been made to our construction equipment, and large amounts of supplies will be distributed by sled this winter, preparatory to an active campaign as soon as conditions are favorable in the spring.

"I feel that we have reason for congratulation on the result of the season's work."

Will Call Conference to Discuss Navy Department Contracts

The Navy Department, Bureau of Yards and Docks, Washington, is arranging for a conference with a number of building trades associations, contracting companies, and other parties interested, for the purpose of discussing its general provisions, specifications and contract requirements. The bureau is particularly desirous of receiving suggestions for improving its general provisions and specifications with a view to making them conform with generally accepted commercial requirements of that character, having in mind that certain statutory requirements and accepted precedents bind government procedure. Upon application to the bureau, interested parties may obtain current copies of the general provisions and specifications for examination. Those contemplating attendance at the conference are requested to send their names to the chief of Bureau of Yards and Docks, who will inform them as soon as practicable of the place and date of meeting.

Suggests Giving Commerce Commission Control of Water Transportation

The thirteenth annual convention of the National Rivers and Harbors Congress was held in Washington, Dec. 6, 7 and 8. Among the addresses delivered were "The Relation of Inland Waterways to Naval Efficiency," by Admiral William S. Benson, U. S. N., chief of naval operations; "The Military Value of Improved Waterways," by Lieut.-Col. Henry Jervey, Corps of Engineers, U. S. A.; "The Economic Value of the New York State Barge Canal System," by Frank M. Williams, state engineer of New York; and "Some Observations on Water Transportation," by Brig.-Gen. William M. Black, chief of engineers, U. S. A. Thomas R. Marshall, Vice-President of the United States, advocated turning over the control of all water transportation to the Interstate Commerce Commission in co-ordination with the control that body now exercises over rail transportation. He advocated also the enlargement of the commission.

Speculation as to the possibility of river legislation had been rife among members of the Congress of the United States and the delegates to the waterways convention, especially in view of Secretary McAdoo's annual report, which shows that on June 30, 1918, there will be a deficit in the Treasury of $185,000,000. Notwithstanding this gloomy outlook as to the condition of the public finances, the delegates to the convention were greatly cheered by Mr. Henry's address. He took the opportunity to say that he believes President Wilson will give his support to the advocates of river and harbor improvement legislation.

Favors Putting Engineers on Cleveland City-Planning Commission

An ordinance now before the City Council of Cleveland will work radical changes with the city-planning commission if it is passed. The personnel of the present commission is five citizen members appointed by each incoming mayor for his term, the mayor and his directors of law, service, safety, finance, utilities and welfare. The suggested legislation would remove the directors from the commission and substitute for them the city engineer, city architect, park engineer and building commissioner. The reason for the change is that it will put on the commission more men actually in touch with city-planning methods and needs. The tentative appropriation for that body for 1917 is $20,000, as against $15,000 for 1916.

Engineering Society Activities

New York Chapter of the National Fire Protection Association, at the Dec. 11 meeting, heard Alexander Brociner, consulting engineer, discuss the fire menace of railroads in the United States. Mr. Brociner also quoted abstracts on his subject taken from the Engineering Record.

American Association of Engineers will hold a national convention Feb. 8, 9 and 10 in Chicago at the Hotel La Salle. Work of a promotional nature will constitute the greater part of the program.

Oregon Irrigation Congress will convene at the Imperial Hotel, Portland, Jan. 4, 5 and 6. More than 500 delegates representing the practical irrigationists are expected to attend.

Calgary Branch of the Canadian Society of Civil Engineers has elected A. Scott Dawson, chief engineer, department of natural resources, Canadian Pacific Railway, to preside as chairman for the ensuing year. Sam G. Porter, assistant chief engineer, irrigation branch, Department of the Interior of Canada, was re-elected secretary-treasurer.

Engineers' Club of Trenton, at the Dec. 14 meeting, held election of officers. The nominees were: President, F. C. Carstarphen; vice-president, C. R. Fairchild; secretary, J. E. English; treasurer, J. E. Elliott.

Engineers' Club of St. Louis will be officered in 1917 by the following men if the slate proposed by the nominating committee is elected: President, F. G. Jonah; vice-presidents, C. S. Ruffner, Baxter L. Brown and G. R. Wadleigh; treasurer, F. L. Bock.

St. Louis Association of members of the American Society of Civil Engineers re-elected Col. J. A. Ockerson, president, at the recent annual dinner. F. G. Jonah and E. E. Wall are the vice-presidents. Gurdon G. Black was re-elected secretary-treasurer.

Colorado Association of members of the American Society of Civil Engineers, at the Dec. 9 meeting, departed considerably from the usual set program. The executive committee presented for discussion co-operation in the engineering societies, formation of a district organization for District 10, discussion of society proceedings, legislative action and participation in public affairs.

Western Society of Engineers will be addressed Dec. 18 by W. W. Marr, Illinois state highway engineer, on "Types of Road for a County Bond Issue."

What Engineers and Contractors Are Doing

F. G. BENNETT, for the last ten years assistant engineer for the New York Board of Water Supply, has resigned to enter the employ of Seth J. Raynor, consulting engineer, of Southampton, N. Y.

E. L. CANNON has been appointed office engineer for the Seaboard Air Line Railway, with office at Norfolk, Va.

F. A. BANKS, construction engineer for the U. S. Reclamation Service on the Jackson Lake enlargement project, has been transferred to Burley, Idaho, as engineer on the Minidoka project. The Jackson dam on which Mr. Banks was engaged was recently completed at a cost of $800,000.

ALBERT A. LANE, contracting engineer, formerly of Youngstown, Ohio, has removed to Cleveland, where he will continue in the general contracting business.

R. W. HEERLEIN, formerly with the McClintic-Marshall Company, of Pittsburgh, has been made contracting engineer for the Massillon Bridge & Structural Company, of Massillon, Ohio. Mr. Heerlein was graduated from Rensselaer Polytechnic Institute in 1911, after which he entered the service of the New York highway department. A short experience on the Coleman du Pont road in Delaware preceded his appointment to the McClintic-Marshall Company in June, 1912.

GEORGE M. WELLS, resident engineer in charge of the building department of the Panama Canal, has been ordered to Washington on special duty. Upon completion of his work in January, Mr. Wells expects to enter a consulting engineering firm that will soon be organized in that city. He was a member of the first engineering party organized for canal service in 1904 and has been on the canal work ever since.

ALVA O. GREIST recently resigned as vice-president and chief engineer of the Burling Engineering & Construction Company of New York City to become consulting engineer on public utility properties. Mr. Greist has been connected with the W. H. Schott Company of Chicago, the American Public Utility Company of Grand Rapids and the New York Steam Shovel Company.

W. D. KRAMER has left the employ of the engineering department of Indianapolis to join the Kuert Contracting Company in that city. Mr. Kramer will devote his time to flood-prevention work on the White River.

C. E. MORFORD and Charles Mowrey have been appointed chief deputy and chief office deputy respectively in the office of the county engineer of King County, Washington. The appointees will take charge when S. J. Humes, county engineer-elect, is installed in office.

R. H. THOMSON, consulting engineer, former city engineer of Seattle and now member of the city council, recently gave a lecture in Portland on engineering problems of city development. Mr. Thomson's lecture is a part of a course on real-estate development and management given under the extension department of Reed College, Portland.

T. L. BISBEE, assistant engineer in charge of roads in Warren and part of Essex Counties, New York, has returned to Albany for the winter. Mr. Bisbee has been connected with the state engineering and highway departments since 1902. He has charge of the maintenance of 94 miles of state road in Warren County and 27 in Essex County, and will have general supervision of 10 miles which will be under construction next year in the former county.

THERON WASSON has been appointed water engineer for the New Jersey State Department of Conservation and Development, which last July assumed the powers and duties of the old State Water Supply Commission. Mr. Wasson is a graduate of the Carnegie Institute of Technology. During the last three years he has worked on the construction of water power plants and pipe lines in California. He was also engineer for the Linden Water Company and made surveys and investigations for the New Jersey and Pennsylvania joint committee on toll bridges over the Delaware River.

FRANK X. METZER has resigned as assistant superintendent of the Lafayette (Ind.) waterworks, which position he has held since 1904. He has announced no plans for the future.

ARTHUR T. SCHNAIBLE will succeed Mr. Metzer as assistant superintendent of the Lafayette (Ind.) waterworks.

C. C. HUFFINE was recently appointed city engineer of Frankfort, Ind., to fill the vacancy caused by the death of R. H. Boynton. Mr. Huffine resigned as city engineer in 1905 to enter the contracting field, in which he was engaged until his recent appointment. He is a graduate of Wabash College.

GEORGE H. ROYLE of Trenton, N. J., has been appointed head of the new road construction department of the Mercer County Board of Freeholders, in charge of engineering work. William P. Conard has been elected head of the road repair department, and John McCullough, head of the department of bridges and culverts.

GEORGE A. JOHNSON, consulting engineer of New York City, has been engaged by the board of city commissioners, Bayonne, N. J., as engineer in charge of rearrangement and construction of the city sewerage system.

HOWARD MURRAY, vice-president and general manager of the Shawinigan Water & Power Company, of Montreal, has been granted a year's leave of absence. He will be associated with the management of the explosives branch of the Imperial Munitions Board. Julian C. Smith, chief engineer, has been appointed general manager to succeed Mr. Murray.

RAYMOND BAFFREY, president of the Hennebique Construction Company, is in New York City on a furlough. Mr. Baffrey is an officer in the French army and has been at the front since September, 1914. He will return shortly to resume his military duties.

JOHN S. DENNIS, assistant to the president of the Canadian Pacific Railway, has been named by the nominating committee as president of the Canadian Society of Civil Engineers. He is a native of Weston, Ont., and after graduation from the Upper Canada College was engaged on survey work for the Dominion government and later for the Hudson Bay Company's land department. He is a past president of the American Society of Irrigation Engineers.

WALTER HUNT has been appointed city engineer of San Jose, Cal., to fill the vacancy caused by the resignation of Milton Maggini.

G. H. NICKERSON, chief engineer of the Yosemite Valley Railroad, has been retained as consulting engineer by the Crocker Huffman Land & Water Company to plan improvements in the present waterworks of the city of Merced, Cal.

W. LEWIS CLARK has been appointed division engineer on Division 4 of the California Highway Commission, succeeding A. E. Loder, whose appointment as assistant chief engineer of the U. S. Office of Public Roads and Rural Engineering was recently announced in these columns. Mr. Clark has been with the California Highway Commission since its inauguration. In January, 1912, he was made division engineer on Division 7, which position he held until July, 1915. At that time he was transferred to the Sacramento office and made assistant highway engineer, which position he held until assigned to duties with headquarters in San Francisco.

Obituary Notes

EDWARD M. BIGELOW, whose appointment as director of the Department of Public Works of Pittsburgh was announced in the Engineering Record last week, is dead. He was born in 1853 in Pittsburgh and in 1888, after several years' experience in engineering, was made director of the Department of Public Works. He served until 1906 and during his term of office made possible the construction of many of the city's boulevards. When the Pennsylvania highway department was reorganized in 1911 Mr. Bigelow was put in charge. He resigned in 1915. Since then he had been in poor health, and he accepted his recent appointment against the advice of his friends.

ALBERT T. BAILEY, founder and president of the Champion Bridge Company of Wilmington, Ohio, died recently in his seventy-first year.

CHARLES H. HERSEY, president of the Hersey Manufacturing Company, died Dec. 9 at his home in Roxbury, Mass. Mr. Hersey was 85 years old. He designed the engines for Admiral Farragut's flagship in 1857.

FREDERIC HOLLY REED, civil engineer and capitalist, who assisted in building the first experimental electric street railway in this country and later installed trolley lines in various cities, died Dec. 9 in New York City. He was a director in numerous railway, power and lighting corporations throughout this country and in Manila, P. I. He was born Aug. 22, 1865, in Stamford, Conn. Mr. Reed was vice-president and director of J. G. White & Company, and also was vice-president and a director of the Manila Electric Railroad & Light Company, the Manila Electric Railroad & Lighting Corporation, the Manila Suburban Railway, the Philippine Railway Company and the Investors Securities Corporation. He was director of many gas, electric and power concerns, as well as of the J. G. White Engineering Corporation and the J. G. White Management Corporation.

F. C. FISHER, president of the Ferro Construction Company, died Dec. 6 in Chicago. He was born at Lake Linden, Mich., about 45 years ago and was a graduate of the University of Michigan. Mr. Fisher was recently engaged on the construction of the new high-level bridges in Cleveland.

GRANT ROHRER, civil engineer and contractor, of New York City, died suddenly Dec. 12 in his office. He was born in Lancaster, Pa., in 1864, and obtained his first engineering experience in 1885 with contractors on track construction for the Kansas, Nebraska & Dakota Railroad. Two years later he was employed on construction by the Kansas City, Wyandotte & Northwestern Railroad. After a year with that organization, Mr. Rohrer was made assistant superintendent of construction on the Abrams Creek branch of the West Virginia Central & Pittsburgh Railroad, with which road he remained for a year. Mr. Rohrer was engaged in mine surveying in West Virginia for one year. From 1890 until opening offices in New York City he spent most of his time on construction work for the Norfolk & Western Railroad, the Illinois Central Railroad, H. G. Davis Coal Company and R. H. Hood.

Civil Service Examinations

United States—Applicants for positions as electrical draftsmen in the Navy Department at $3.52 to $6 per day should fill in form 1312. From the register of eligibles, vacancies will be filled. Examinations will be held Jan. 3, 1917, for petroleum technologist, salary $1,200 to $1,500; and for transitman, salary $800 to $900 a year. Form 1312 should be filed. Examinations will be held Jan. 9 for leading draftsman, salary $2,400. Applicants should file form 2118.

Examinations will be held Jan. 3 for examiner of surveys, salary $1,200 to $1,500 a year, and for topographic aid, salary $40 to $75 per month. Examinations will be held Jan. 3 and 4 for junior mechanical engineer, salary $1,000; junior fuel engineer, salary $1,200; geologic aid, salary $1,500; junior topographer, salary $720 to $1,200. Form 1312 should be filled in by applicants for all of these positions.

California—Examination will be held Jan. 6 for assistant to the chief engineer of the Board of State Harbor Commissioners of California, salary $3,000. The duties of the position involve the design and supervision of the erection of structures of reinforced concrete, steel and timber, and familiarity with the fabrication and placing of steel reinforcement, the proportioning, mixing and placing of concrete to give the best results, timber framing and the fabrication and erection of structural steel. The candidates must be residents of California.

Examinations Previously Announced

Date.		See Eng. Rec.
Jan. 3.	Laboratorian qualified in strength of materials, United States	Dec. 2
Dec. 26.	Petroleum economist, United States	Dec. 2

Blaw Company Holds Sales Convention

The annual sales convention of the Blaw Steel Construction Company was held recently in Pittsburgh. After inspecting the plant, Mr. McArthur, chief engineer, Mr. Rawley, general superintendent, and Mr. Loxterman, manager of the service department, spoke briefly on new appliances and new methods in concrete form construction worked out during the past year.

The new Blaw bucket was the topic of conversation in the afternoon, as well as on Saturday, and was described in detail by Mr. McWhirk, who is in charge of the bucket department. As has been the custom in the past, the convention ended with a banquet at the Concordia Club. More than sixty Blaw enthusiasts were present.

Issue Miniature Size Catalog

Departing from the usual custom the Stow Manufacturing Company of Binghamton, N. Y., has issued Bulletin 102 in miniature. The booklet, which is complete in every detail, measures only 3x5 in. It contains more than 100 pages, is well illustrated and its size makes it convenient for ready reference.

Business Notes

Waterworks Manufacturers Association will hold a special meeting of the executive committee Dec. 20 at the Machinery Club, New York City.

National Tube Company provided three motion pictures illustrating the manufacture of National pipe for the entertainment at the meeting of the American Society of Marine Draftsmen last evening. The assemblage was in the Onyx Theater, Newport News.

Terry Steam Turbine Company, Hartford, Conn., has appointed Stephenson & Nichols, Monadnock Building, San Francisco, to represent the firm in parts of California and Nevada.

Troy Wagon Works Company, Troy, Ohio, has appointed the O'Rourke-Miller Motor Company as its representative in New Orleans. A complete line of Troy trailers will be maintained at the new branch.

Asbestos Protected Metal Company, Pittsburgh, has appointed Meyer Davis to take charge of the San Francisco office. Mr. Davis was formerly chief engineer of the company.

Stambaugh-Thompson Company has taken over the business of the Benson-Caldwell Machinery Company, of Youngstown, Ohio. A new department has been opened in charge of Ivan W. Benson to handle contractor's supplies.

Lidgerwood Manufacturing Company, of New York City, has opened an office in the Hibernian Building, Los Angeles, in charge of Charles A. Baechtold.

Purington Paving Brick Company, of Galesburg, Ill., has become a licensee of the Dunn Wire-Cut-Lug Brick Company of Conneaut, Ohio.

Clay T. and John Gould recently established the Conway Fir Commission Company with headquarters at Conway, Wash. The firm will handle building materials and supplies after the first of the year.

Ransome Concrete Machinery Company, of Dunellen, N. J., has just opened another factory at Reading, Pa. This will double the output of the company in the line of small mixers and road paving machinery. The new factory was necessary to take care of increased business.

An unusually large shipment of paving equipment has been made to Torrance & Portal, of Havana, Cuba, who have secured extensive paving contracts in Havana and Cienfuegos. This shipment, made by the Iroquois works of the Barber Asphalt Paving Company, consisted of six cars routed by way of Key West, Florida, carrying two 3-unit asphalt plants, two 2000-gal. and one 1000-gal. steam-heated melting kettles, four tandem rollers, two portable boilers and engines, fire wagons, paving tools, etc.